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A study on the Introduction Strategies of Environmental Education Programme for Children Reusing Existing Forest in Forest Botanical Garden of Heilongjiang Province

흑룡강성 삼림 식물원 내 숲을 활용한
어린이 환경교육 도입 방안 연구

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서울대학교 환경대학원

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A study on the Introduction Strategies of
Environmental Education Programme for Children
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Heilongjiang Province

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Abstract

A study on the Introduction Strategies of Environmental Education Programme for Children Reusing Existing Forest in Forest Botanical Garden of Heilongjiang Province

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Urban forest botanical garden is not only have ecological significance in the city, but also have educational significance. Heilongjiang Forest Botanical Garden, as the unique forest botanical garden located in the city center of China, its forest resources are abundant, accounting for 80% of the botanical garden's area. The function of forest environmental education are of great theoretical and practical significance to awaken the public's forest ecological awareness and improve environmental protection awareness. Due to the high accessibility, urban forest botanical garden provides an excellent place for the development of forest environmental education. The goal of environmental education is to let children to understand the northern forest through activities, as well as the natural environment they live in. This programme of HFBG can be a start to stress the importance of forest education especially for

children to realize sustainable forest utilization and conservation. Through the analysis on the site, 3 directions of education program planning are decided: 1. The education content should be summarized from the site. 2. Different types of FEE Programmes for Different Age groups. 3. When considering the operation, the programme should be 3 type: Regular programme and Permanent programme in Botanical garden and a school – botanical garden corporation programme. The content of forest education in HFBG should be classified into 3 component : 1. Forest resources (use of forest products) 2. Natural environment (Forest environment, forest ecosystems) 3. Regional culture (Natural features, Regional culture). 8 regions in total were selected as the place for environmental education programmes. The education contents of each region are as follows: Knowing trees, Northern Nomadic Story with Birch, Camphor pine forest and life, Knowing Butterflies, Garden management, Clove from afar, Mysterious northern forest, Learn the value of Yew. As a result, considering the children's development, there are 16 activities in total in eight areas are proposed. The cooperation of various social sectors may be a feasible way under the premise of the long-term forest environmental education activities in the botanical garden. 4 Management Models such as, Government-led Management Model, Government Sponsored Young Entrepreneurs projects model are proposed. Also, 4 operation method including Cartoon image for propaganda, Combination with school curriculum, the Special Prevision for Education Programme, are showed in this paper.

keywords : Forest, Environmental Education, Botanical Garden, Children's Development

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Chapter 1 Introduction

1.1 Research Background and Purpose

1.1.1 Research Background

In November 2012, at the 18th National Congress of the Communist Party of China, the construction of ecological civilization was proposed to realize the “Chinese Dream- Beautiful China“, essentially to improve the ecological socialist system. President Xi Jinping pointed out that China should accelerate the reform of the system of ecological civilization to reach the “Chinese Dream- Beautiful China“ in the at the 19th National Congress of the Communist Party of China again. The results of two surveys in China show that the weak environmental awareness of Chinese citizens is closely related to the lack of environmental education. According to the national survey of public environmental awareness (CEAP) in 2007, one of the most important social issues in China is environmental pollution, which is caused by subjective factors such as lack of environmental awareness; Another one, People’s Daily, reported that in 2010, only 3.27% of Chinese citizens had basic scientific literacy (including environmental awareness and behavior), which is equivalent to the level of Japan, Canada and the European Union and other major developed countries in the late 1980s (Wan Jin and Chen Young, 2013).

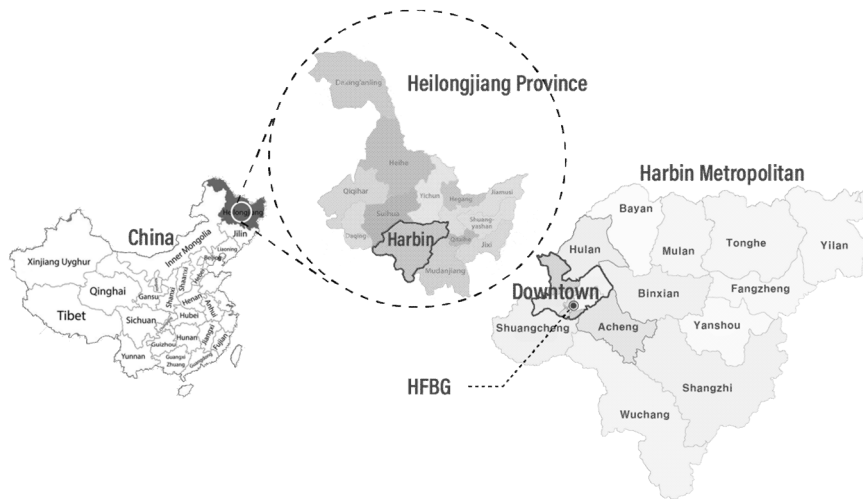
As we know, many botanical gardens at home and abroad take environmental education as an important function. Although the domestic environmental economic education started relatively late, in recent years, China attaches great importance to environmental education (Jiao yang et al., 2019). With the

construction of Shanghai Chen Shan botanical garden, the message of enhancing environmental awareness has been sent to the whole country. Chenshan botanical garden was awarded “National Base of Science Popularization and Education in 2012. In terms of infrastructure construction, most of the botanical gardens in China have science museums, greenhouses, theme garden. As a place for environmental education, the exhibitions are held all year round to popularize the knowledge of plants and environmental science to visitors (Jiao yang et al., 2019).

Urban forest botanical garden is not only of ecological significance in the city, but also of educational significance. The function of forest environmental education are of great theoretical and practical significance to awaken the public's forest ecological awareness and improve the public's environmental protection awareness. Due to the high accessibility of Urban Forest Park, urban forest botanical garden provides an excellent place for environmental education and also provides resources for the development of forest environmental education.

Heilongjiang forest botanical garden is the only one forest botanical garden located in the downtown area in China (Meng Bi, 2014). It is located in Harbin, the capital city of Heilongjiang province (Figure 1-1). It has abundant plant resources, especially forest resources. It plays an important role in the study of plant germplasm resources, the protection of plant diversity, the popularization of plant knowledge and the sustainable development of plant resources in northeast China. However, at present, the forest botanical garden in Heilongjiang province does not pay enough attention to the forest environmental education

and the experiential environmental education base. For the sustainable development of forest botanical garden in Heilongjiang Province, it is necessary to make a set of forest environmental education program, make full use of this valuable forest resources, provide well-being for people's life, and arouse people's environmental awareness.

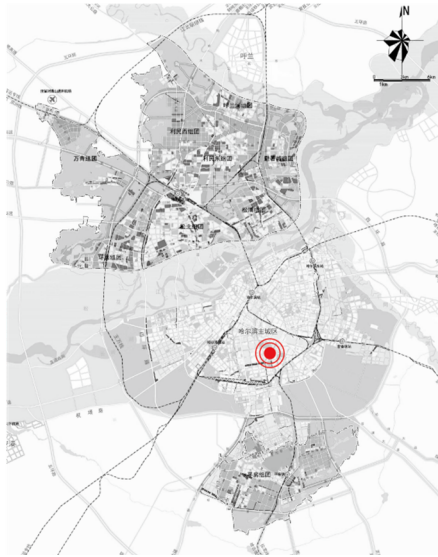


[Figure 1-1] Location of Heilongjiang province and Harbin Municipality

1.1.2 Research Purpose and Significance

As the unique forest botanical garden located in the city center (Figure 1-2) (Meng Bi, 2014,). Its forest resources are abundant, accounting for 80% of the botanical garden's area. It is of great significance to the study of plant germplasm resources, the protection of plant diversity, the popularization of plant knowledge and the sustainable development of plant resources in northeast China. There are Camphor tree, Dahurian larch, Silver birch and Rhododendron in Heilongjiang Forest Botanical Garden. They are the representatives of Daxinganling forest area. The representative forest areas of Changbai Mountain

include Fir, Korean pine, Chinese yew, Larch, Manchurian ash, oak, walnut tree, etc. Korean pine, Spruce, Fir, Oak and Lespedeza represent the plants of Xiaoxing'an Mountains. These trees are in good condition in the forest botanical garden of Heilongjiang Province. Most of them are 15-20 meters high and more than 40 years old.



[Figure 1-2] Location of the Heilongjiang Forest Botanical Garden

According to the statistics at the end of 2018, Harbin has a population of 10.858 million, and the population of the main urban area is 4.6 million. The main urban area is 10198 km², which is including Songbei Hulan District, Pingfang District, Xiangfang District, Nangang District, Daowai District, Daoli District. In the center of such a big city, it is very rare to have 136 hectares of forest botanical garden. The downtown area is still expanding, and transportation planning makes it easy for people to reach the botanical garden in the future, which brings opportunities for the development of botanical garden.

Heilongjiang Forest Botanical Garden was founded in 1958. It has a history of 60 years. Since 1988, with the development of economy, more and more attention has been paid to the development of botanical garden in China, and the open area of Forest Botanical Garden of Heilongjiang Province is also expanding rapidly. From 2002 to 2007, the botanical garden of Heilongjiang province continued to establish new specialized gardens but it ignored its own inherent characteristics, that is the high coverage of the forest resources. however, as for environmental education, no matter in facilities or programmes, it has not been well developed.

The forest botanical garden in the center of a city is the best place for urban residents to directly contact with nature, understand nature and obtain knowledge of forest ecological environment. In recent years, China also attaches great importance to the establishment of ecological civilization. Considering the existing abundant forest resources of Heilongjiang Forest Botanical Garden, this paper hopes that through this strategies introduction of environmental education programme for children reusing existing forest, this valuable urban forest resources can be well used.

1.2 Research Scope

1.2.1 Spatial Scope

The whole garden is divided into two parts by Haping road (Figure 1-3). The west part is birch forest belt and the nursery stock center of the botanical garden is closed to the visitors. The open area is the east side of Haping road, which has 16 special gardens here open to the public. Therefore, this paper takes the open area as the research scope of this paper (Figure 1-4).



[Figure 1-3] Two parts of Forest Botanical Garden



[Figure 1-4] Research scope

1.2.2 Research object

According to According to Environmental Education in Botanic Gardens

-Guidelines for developing individual strategies reported by BGCI, it is pointed that the main target groups for most gardens will include at least some of the following: schools (infant, primary and secondary) teachers, colleges and universities, youth clubs, farmers and horticulturists, businesses, community groups, etc. An important step in the formation of an education plan is to decide exactly whom the programmes will be targeted at. In OECD's Environmental Education Research Report, the key period of environmental awareness formation is 2-16 years old. This age group belongs to children. Although other target groups are important, this study decided to focus on just children.

1.2.3 Content Scope

Through literature research, this paper expounds the significance of forest environmental education, children's cognitive and behavioral characteristics in different age groups. Through case analysis, the content of forest environmental education is summarized. Then analyze the general situation of the site, natural resources and human resources, etc. Combined with the existing resources of the site, a set of environmental education program suitable for the site is developed. Then according to the research of the relevant institutions of environmental education, points out the potential implementers of the implementation subject suitable for the site.

1) Literature and case studies

Through literature analysis and practical case analysis, clear the definition of urban forest botanical garden, the relationship between urban forest botanical

garden and environmental education, etc. Explain the social significance of forest environmental education. Children's cognitive development in different years, types of play in the natural environment, etc. The case studies showed the advanced forest environmental education projects lately, and Environmental education programmes suitable for the site were selected in the first step as set of alternatives. The further design of specific scheme pays more attention to the particularity of the site.

2) Current situation analysis

The current situation analysis includes the analysis of the site and the analysis of the relevant institutions of environmental education. The site analysis includes the general analysis of location and surrounding environment, the analysis of landscape in the site, and the analysis of natural resources, especially forest resources. In the analysis of forest resources, the distribution of representative trees, seasonal ornamental trees, butterfly habitats, aromatic trees.

3) Analysis of potential implementer of programme

The analysis of related institutions of environmental education includes the analysis of government agencies, government-sponsored institution, and educational institutions. Through the investigation of the organizational structure and responsibilities of the management organization of the botanical garden, as well as the investigation of the relevant forestry departments in China, we hope to find the departments that can be proposed. And through the investigation of surrounding schools, find potential partners.

4) Design of environmental education program

After the analysis of the existing forest resources, the cognition of the design object and the learning of the playing behavior, a set of environmental education scheme is designed based on the activities screened out for the first time after the case analysis and combined with the particularity of the site.

1.3 Previous Research

1.3.1 Forest Environmental Education related

For the research of forest environmental education, most of them clarify the basic problems of domestic forest environmental education through literature review. On the basis of foreign case studies, summarize the experience, and then combined with the field survey, find the corresponding forest environmental education program.

Author	Research Topic	Research Content
Kwon, Young-Ky (2012)	Plan and design guidelines for forest kindergarten : using the forest near Seoul National University	This paper summarizes the theory of children's activities and forest kindergartens, investigates the management organization of kindergartens in universities, and observes children's activities, then puts forward the suitable programmes for children, space design elements and the Plan and design guidelines for forest kindergarten.
Yi, Yoo-ri (2013)	The practice of Forest kindergarten education and it's implications in environmental education	The research adapts a ethnography among qualitative methodology through collecting, describing, analyzing and interpreting from in participant observation, interview, ancillary investigation to find out what the Kumtang's everyday life is, what the character of education is, what people experience. The results show that the natural school is composed of children, teachers and parents. The education of forest kindergarten may become the media of local environmental education, community environmental education, alternative life and education.

[Table 1-1] Forest Environmental Education related Previous Research 1

Kongsak Thathonga and Sunee Leopenwong (2014)	The Development of Environmental Education Activities for Forest Resources Conservation for the Youth	This study was an action research aimed to study the effect of the cooperative developed learner-centered on integrated subjects' map of education for the environment toward students' responsibility and awareness of natural resource conservation. The findings indicated most of the students were aware of the important and benefit of the trees toward society environment and oneself.
Yan Di (2016)	Research and promotion planning on the environmental education of Hunan forest botanical garden	Forest education mainly includes people, project, facility and operations management. Through analyzing these four main factors, The article puts forward some aspects of the design points.
Jin Wan (2013)	The development of Forest Education in developed countries and Its Enlightenment	By summarizing the experience of Forest Education Development in Britain, Germany, America and Japan, we can provide enlightenment and reference for the diversification of life education, environmental education and teaching forms in China.

[Table 1-2] Forest Environmental Education related Previous Research 2

1.3.2 Botanical Garden and Environmental Education related

Insufficient papers about environmental education in botanical garden in China, and different from foreign countries which have rich practical experience, China is still in the theoretical stage.

Author	Research Topic	Research Content
Mingle Ma (2019)	Using the theory of “method destination chain” to explore the effect of night tour environmental education in botanical garden	In this paper, 30 participants of the night tour in Xishuangbanna Tropical Botanical Garden were interviewed in depth. Analyze the influence and value of environmental education’ s function. Explore the application value and development strategy of environmental education in botanical garden
XIE Wei-hang and PAN Jian-fei (2019)	Case Analysis Of Children’s Environmental Education System in the Anglo-American Botanical Garden	This paper analyzes the children’s environmental education system of Kew Gardens, Edinburgh Royal Botanic Gardens, Chicago Botanic Gardens and Brooklyn Botanic Gardens, and summarizes the commonness of the children’s environmental education system of British and American botanic gardens. Then puts forward the direction and specific methods of environmental education for children in botanical gardens in China
Ivana Zelenika (2018)	Sustainability education in a botanical garden promotes environmental knowledge, attitudes and willingness to act	In the Sustainable Communities Field School (Field School) program, participants from local organizations are guided by instructors through University of British Columbia Botanical Garden, while receiving verbal and experiential education on topics of food systems and choices, biodiversity conservation, water conservation, and waste reduction. The results suggest that interactive sustainability education in a botanical garden setting can be a useful education model to mobilize public engagement on sustainability.

[Table 1-3] Botanical Garden and Environmental Education related Previous Research

1.3.3 Chinese Botanical Garden Development Strategy related

In recent years, there are many articles about the development strategy of Chinese botanical garden, including the regular reports published by the authoritative institution Chinese Academy of Sciences and many scholars' dissertations. Many of them pointed out the lack of environmental education in Chinese botanical garden. The future development of Chinese botanical garden should pay more attention to environmental education.

Author	Research Topic	Research Content
Jiao Yang (2019)	Current situation and future development strategy of Chinese botanical garden	Take the Botanical Gardens in nationwide as the object, systematically tell the current situation, shortage and development strategy of Botanical Garden
Yu Zhang (2017)	Inspiration from the development of Kew garden in the Royal Botanical Garden	The research on the development history and current situation of Kew garden in the Royal Botanic Garden of the UK will provide enlightenment for the development of Chinese botanical garden and the protection of plant resources.
Hong Wu (2012)	The Study of the Sustainable Development of Chinese Botanical Garden through the Situation Analysis of American Botanical Gardens	Based on the analysis of the current situation and challenges of American Botanical Garden since the economic crisis, this paper discusses the Enlightenment of sustainable development of Chinese botanical garden, and puts forward the development direction and comprehensive management of botanical garden in the future

[Table 1-4] Chinese Botanical Garden Development Strategy related Previous Research

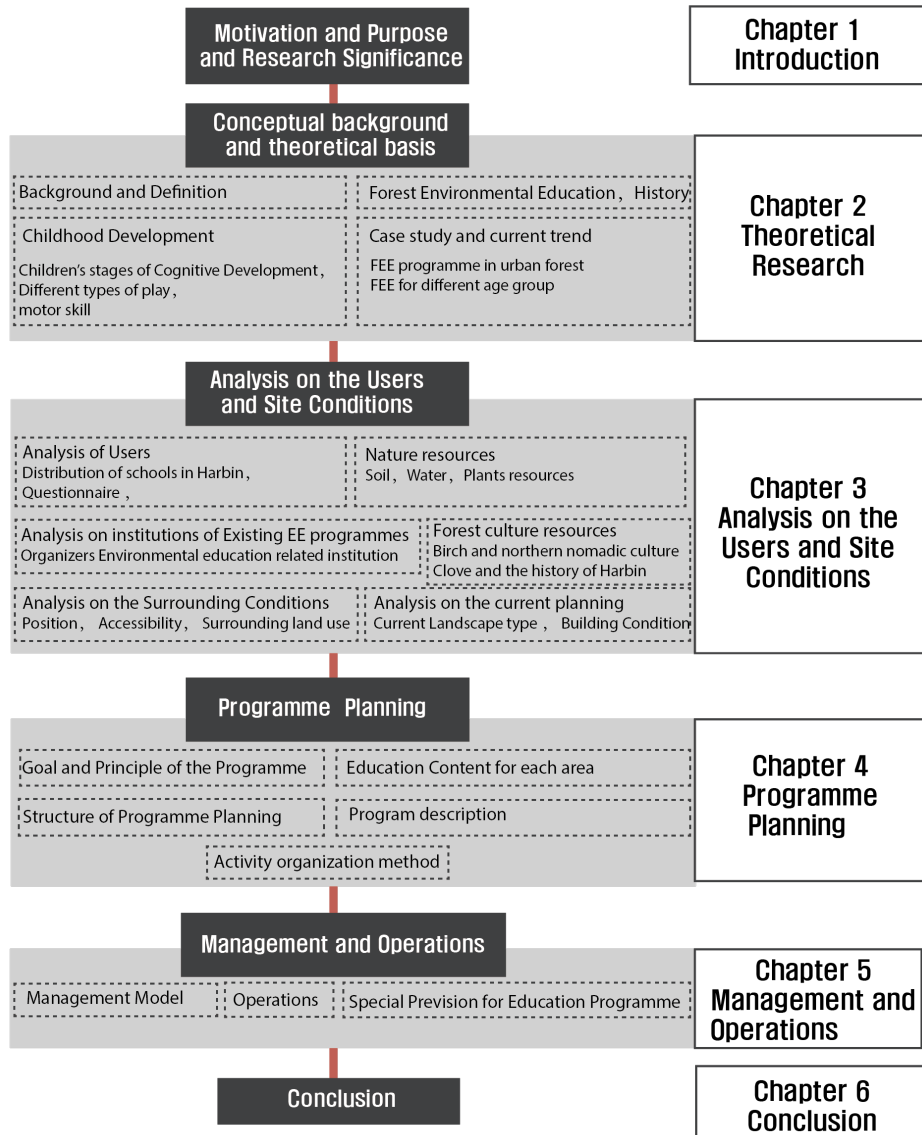
1.3.4 Forest Botanical Garden of Heilongjiang Province related

The research of Heilongjiang forest and botanical garden mainly focuses on the ecological benefits, the construction of landscape health evaluation system, the application for plant management, bio-diversity, landscape aesthetics evaluation.

Author	Research Topic	Research Content
Ning Xv (2018)	Microclimate effect of forest botanical garden and its influence on tourists' behavior in Heilongjiang Province	Based on a large number of practical investigation and observation data, this study studies the microclimate change in different spaces of Forest Botanical Garden in Heilongjiang Province in spring, summer and autumn and its influence on the thermal comfort and behavior of tourists from two aspects of thermal comfort and behavior observation In order to provide suggestions for improving the quality of recreation space of Forest Botanical Garden in Heilongjiang Province.
Shunan Feng (2018)	Study on the plant landscape characteristics of Forest Botanical Garden in Heilongjiang Province	Taking the open area of botanical garden as the research object, based on the collected botanical species, photos of plant ornamental characters and NCS color value data, this paper analyzes the current characteristics of its plant landscape, summarizes its shortcomings and puts forward countermeasures for improvement
Yong Zhou (2017)	A study on the planning and design of tulip special garden: Focus on the tulip special garden of Heilongjiang Forest Botanical Garden	This paper expounds the ornamental characteristics and other application values of tulip, and takes the tulip special category garden of Heilongjiang Forest Botanical Garden as an example to analyze the site selection, plant configuration and planning layout of tulip special category garden planning and design, so as to provide reference for the construction of local tulip garden

[Table 1-5] Forest Botanical Garden of Heilongjiang Province related Previous Research

1.4 Research Process



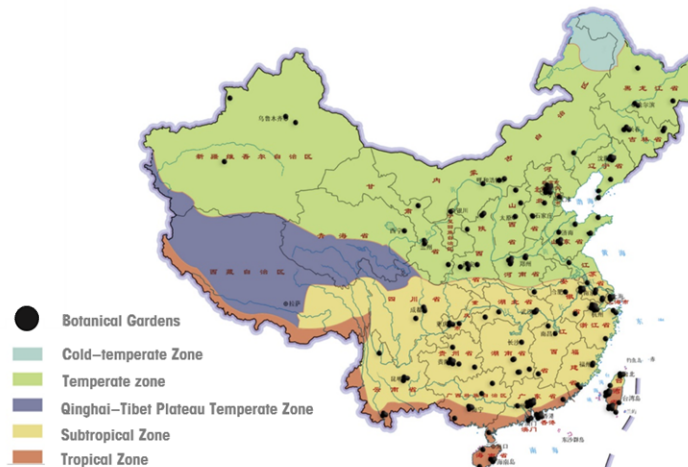
[Figure 1-6] Research Process

Chapter 2 Theoretical Reference and Case Analysis

2.1 Botanical garden

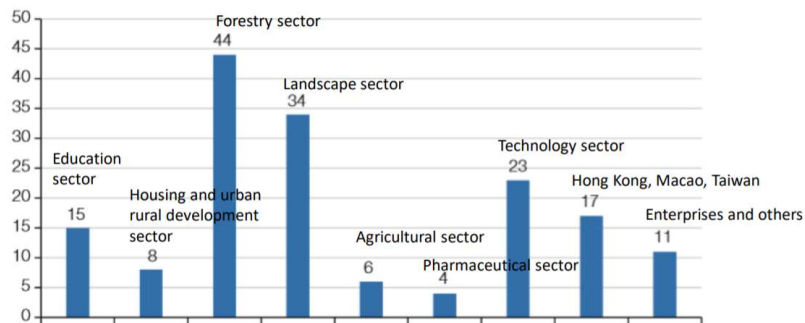
2.1.1 Chinese Botanical Garden

The first modern botanical garden in China is the Nanjing Zhongshan botanical garden, which was built in 1929. Before the founding of new China, there were only 8 botanical gardens. After 1949, the Chinese academy of sciences, with the support of the government, rebuilt and built 36 botanical gardens nationwide. According to the statistics of the International Association of Botanical Gardens (IABG), there are 2119 botanical gardens in the world, 162 Botanical Gardens in China(Figure 2-1). These botanical gardens cover the country's major climate zones, Tropical zones (32), Subtropical Zone (68) and Temperate zone(62).



[Figure 2-1] Locations of Botanical Gardens in China

The main administrative and subordinate administrative units of those 162 botanical gardens in China include the Science and Technology Department (including the Chinese Academy of Sciences), the Education department, the Housing and Urban/ Rural development, the Forestry department, the Landscape department, the Agriculture department and the Medicine department, and there are also many botanical gardens in Hong Kong, Macao and Taiwan(Jiao yang et al., 2019) (Figure 2-2).



[Figure 2-2] Affiliation of Chinese botanical garden¹⁾

According to the report on the current situation and future development strategy of Chinese botanical garden in 2019 issued by the Chinese Academy of Science s²⁾: At present, there are still many problems and deficiencies in China's botanical gardens, such as the imperfection of the environmental education

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- 1) 中国植物园现状及未来发展策略, Jiao yang et al., "Current situation and future development strategy of Chinese botanical garden", Journal of the Chinese Academy of Sciences, Vol. 12, 2019, p.1352
 - 2) The Chinese Academy of Sciences is the linchpin of China's drive to explore and harness high technology and the natural sciences for the benefit of China and the world. Comprising a comprehensive research and development network, a merit-based learned society and a system of higher education, CAS brings together scientists and engineers from China and around the world to address both theoretical and applied problems using world-class scientific and management approaches. At present, CAS manages 15 Botanical Gardens (including those jointly managed by local governments), with a total area of 68319.7 hectares, accounting for 67% of the total area of botanical gardens in China.

system which is seriously affected the future development strategy of Chinese of botanical garden.

2.1.2 Urban Forest Botanical Garden

Forest botanical garden is a special park with a considerable area of artificial forest or natural forest as the main body. The forest botanical garden is a scientific research institution and place for investigating, collecting, identifying, introducing, domesticating, preserving and popularizing the utilization of plants, as well as scientific research, popular science, teaching plant science knowledge, and providing ecological leisure tourism. It is also a place that can provide scientific education and cultural recreation on a certain scale (Fu Tingjun, 2016). The function of the forest botanical garden is not only to attract tourists to the botanical garden, but also to improve tourists' understanding of environmental protection and ecological protection.

The urban area is the center of commerce, culture, history and politics. The botanical garden located in the city center has good geographical conditions and should provide full contact opportunities for urban residents. The recent botanical garden is different from the past. The current urban botanical garden is trying to integrate into the life of urban residents and establish close ties with urban residents and become a part of them (Jo-Sang Kwon, 2017).

“Urban forest” first appeared in the United States. In 1962, “urban forest” was first applied to the investigation of outdoor recreation resources in the United States. Paul H. Gobsterr (1994) defined urban forest as “a complex of all forests in all roads or communities in the city, including woody plants, herbaceous

plants, etc.". It also be defined in Germany. Flack (1996) , put forward a broad concept of urban forest, that is, "urban forest does not include the traditional urban green space, park, garden and street tree in the city, but all the forests around the city and in the city in addition".

With the development of society and the rapid development of ecological construction, urban forest gradually appears in people's vision and gets more attention. Domestic scholars also have a wide range of research on urban forest related concepts. In 1996, it was first defined as "plants planted in and around the city, mainly high trees and low shrubs, including urban street greening, parks, near and far suburb forest parks, production protection forests, water conservation forests, etc.".

2.2 Forest Environmental Education for children

2.2.1 Definition of Environmental Education and Forest environmental education

Modern environmental education began in 1960s-1970s, which marked the birth of environmentalism with the appearance of R. Carson's silent spring. In 1970, the promulgation of "environmental education law" in the United States promoted the improvement of American environmental awareness. Environmental education, as a proper term, began to appear frequently in various international conferences and academic works.

William B. Stapp (1930-2001), Who is considered the founder of environmental education, said that the environmental education is aimed at producing a

citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution in 1969. According to the Tbilisi Declaration, in 1978 environmental education is a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action. Its definition has been changed over times. The most representative definition in China was put forward in 1996 by Xu Hui and Zhu Huaixin: "environmental education is an educational science characterized by interdisciplinary activities to arouse the environmental awareness of the educated so that they can understand the relationship between human beings and the environment, develop skills to solve environmental problems, and establish correct environmental values and attitudes.

Many experts have made the definition of forest environmental education. Japan started early in forest environmental education and accumulated a lot of experience. The definition of forest education is: "Learning through direct experience in forest for human resources; learning about forests that are the regional natural environment bestowing renewable resources and that increase human's sensibility to nature; nurturing skills and awareness associated with forests; and nurturing human resources who can live with nature environmentally sound way and can contribute to a sustainable society." (INOUE M., OISHI Y., 2014).

2.2.2 History of Forest Environmental Education at home and abroad

In 1952, Ella flatau founded the first forest kindergarten - “walking kindergarten”. The Danish mother Ella flatau who takes her two children with her every day found that children who stay outdoors longer are more willing to communicate, have better balance and physical fitness than ordinary children. In the mid-1990s, the thought of Danish forest kindergarten model was introduced into Britain. Since then, forest education has developed rapidly in Britain, Germany and Japan. The rising forest school can help children develop healthy life style, teamwork ability, positive and healthy mentality, and make them become learners who love life and nature, so as to promote their healthy development; especially for children’s social ability and positive emotional development and self-confidence. It points out the direction for a healthier and greener education (Wan Jin and Yang Cheng, 2013).

Forest education has made unprecedented development since it was introduced into Britain in the 1990s. The British forest school was pioneered by Bridgewater college, which was founded in Somerset in 1993. In the 21st century, British government departments launched activities such as “going to the green land”, “starting from the park” and “active forest movement”, and civil organizations such as “rural youth” and “Natural England” emerged.

Ryan F. Reese said, “The United State Forest Service (USFS) developed the national Children’ s Forest initiative in the 2000s to encourage regional districts and partners to develop consortiums that advance national and local EE initiatives (Children’ s Forest’ s 2018). Currently, 25 Children’ s Forests exist across the United States^{“3)}. According to the United States Department of

Agriculture Forest Service, “ Today, more than 80 percent of American families live in urban areas, and many lack easy access to safe outdoor spaces. At the same time, kids are spending more hours than ever in front of screens instead of outside” 4).

In Asia, Japan’s natural education is very representative. Japan is bestowed with rich forest that covers 67% of the land. Forestry education in Japanese schools and some national environmental activities associated with forestry have been conducted for more than 100 years.

In China, only 5% of mothers say their children often explore nature (preface of Richard Louv’s *Last Child in the Woods* in Chinese version). Nowadays, school education has great limitations. For example, many current education focus issues, such as primary school students’ academic burden, students’ mental health education, “boy crisis” and other issues. Through forest environment education, children’s thoughts and hands will be liberated, and they will be encouraged to be brave in innovation, practice, learn to learn, and know how to learn and live independently, so as to promote their all-round development and individual development. Although China started late in forest environmental education, it began to get attention in recent years. China South Korea cooperation Badaling Forest experience center was opened to the public on June 3, 2014, which is the first forest culture experience system in China. Lion International Forest School, the first forest education school in China,

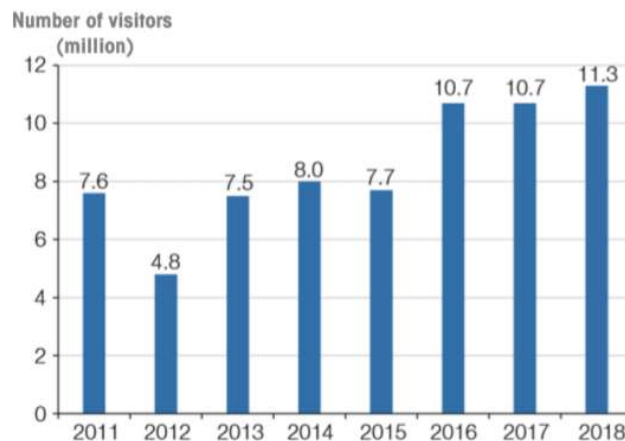
3) Reese, Ryan F, “Adult stakeholder perceptions of 4th grade participation in children’s forest environmental education programming.”, *Environmental Education Research*, vol. 24, 2018, p. 1211.

4) <United States Department of Agriculture Forest Service> ,
<<https://www.fs.usda.gov/detail/tonto/learning/kids/?cid=fseprd531626> > (2020. 06. 28)

located in Tianhe District, Guangzhou City, was founded in 2015.

2.2.3 The Relationship between Botanical Garden and Environmental Education

Environmental education of botanical garden is an important part of social environmental education. Carrying out environmental education is a window for botanical garden to show its scientific connotation to the public, which is helpful for the realization and development of botanical garden functions. Under the guidance of the botanical garden of the Chinese Academy of Sciences, the botanical garden of China has achieved good social benefits (Figure 2-3) in promoting scientific education for primary and secondary schools, winter and summer camps and research practice, environmental education research, as well as scientific education and environmental education activities of the botanical garden with the characteristics of the Chinese Academy of Sciences⁵⁾.



[Figure 2-3] Number of visitors to botanical garden of Chinese Academy of Sciences from 2011 to 2018⁶⁾

5) 中国植物园现状及未来发展策略, Jiao yang et al., “Current situation and future development strategy of Chinese botanical garden”, Journal of the Chinese Academy of Sciences, Vol. 12, 2019, p. 1355.

6) 中国植物园现状及未来发展策略, Jiao yang et al., “Current situation and future development strategy of Chinese botanical garden”, Journal of the Chinese Academy of Sciences, Vol. 12, 2019, p.1355

Experiments in China show that activating five senses can stimulate tourists' interest in learning, and improve tourists' self satisfaction and personal value. The environmental education project of the botanical garden should design more personal experience links, such as guiding tourists to hear the surrounding sound, smell of the nature, touch the animals and plants that will not hurt people, which can increase the personal experience of tourists and enhance the contact between people and nature(Ma Mingle, 2019).

2.3 Childhood Development

Environmental education for children is different from that for adults who have been fully developed. Children spend most of their time playing. Play is a child' s first education experience. It is the way they connect to others and learn about themselves. Play teaches children important skills and prepares them for life skills they will use throughout their childhood and adult lives. In order to support learning through play for young children, before designing a set of environmental education program, it is necessary to accurately grasp the children's psychology, cognition and play behavior.

2.3.1 Children' s stages of Cognitive Development

Cognitive development is the construction of thought processes, including remembering, problem solving, and decision-making, from childhood through adolescence to adulthood⁷⁾. Understanding children's cognitive development stage is the basis of understanding children's inner world, and then understand

7) <Children's Health>

<<http://www.healthofchildren.com/C/Cognitive-Development.html#:~:text=Cognitive%20development%20is%20the%20construction,childhood%20through%20adolescence%20to%20adulthood.>> (2020. 06 28)

their reaction to external environment. Cognitive development is a field of study in neuroscience and psychology focusing on a child's development in terms of information processing, conceptual resources, perceptual skill, language learning, and other aspects of the developed adult brain and cognitive psychology.

Jean Piaget was a major force establishing this field, forming his "theory of cognitive development". Jean Piaget's theory of cognitive development, which has been recognized as the most authoritative theory of development psychology in the 20th century, suggests that children move through four different stages of mental development. His theory focuses not only on understanding how children acquire knowledge, but also on understanding the nature of intelligence. He clearly pointed out the major Characteristics and Developmental Changes (Table 2 -1). Piaget's stages are:

The Stages	Major Characteristics and Developmental Changes
Sensorimotor stage: birth to 2 years	<ol style="list-style-type: none"> 1. The infant knows the world through their movements and sensations 2. Children learn about the world through basic actions such as sucking, grasping, looking, and listening 3. Infants learn that things continue to exist even though they cannot be seen (object permanence) 4. They are separate beings from the people and objects around them 5. They realize that their actions can cause things to happen in the world around them
Preoperational stage: ages 2 to 7	<ol style="list-style-type: none"> 1. Children begin to think symbolically and learn to use words and pictures to represent objects. 2. Children at this stage tend to be egocentric and struggle to see things from the perspective of others. 3. While they are getting better with language and thinking, they still tend to think about things in very concrete terms.
Concrete operational stage: ages 7 to 11	<ol style="list-style-type: none"> 1. During this stage, children begin to think logically about concrete events 2. They begin to understand the concept of conservation; that the amount of liquid in a short, wide cup is equal to that in a tall, skinny glass, for example 3. Their thinking becomes more logical and organized, but still very concrete 4. Children begin using inductive logic, or reasoning from specific information to a general principle
Formal operational stage: ages 12 and up	<ol style="list-style-type: none"> 1. At this stage, the adolescent or young adult begins to think abstractly and reason about hypothetical problems 2. Abstract thought emerges 3. Teens begin to think more about moral, philosophical, ethical, social, and political issues that require theoretical and abstract reasoning 4. Begin to use deductive logic, or reasoning from a general principle to specific information

[Table 2-1] Major Characteristics and Developmental Changes in each Stages

Source: <https://www.verywellmind.com/piagets-stages-of-cognitive-development-2795457>

2.3.2 Different types of play of different age group

1) Mildred Parten' six different types of play

Mildred Bernice Parten Newhall (August 4, 1902 – May 26, 1970) was an American sociologist, a researcher at University of Minnesota's Institute of Child

Development. In her doctoral dissertation in 1929, she developed the theory of six stages of child's play. It led to a series of influential publications, and it is still cited today. She researched the development of social play (Table 2-2) in children aged 2-5 and discovered that a child's development of his/her social skills is reflected in the way they play.

The Stages	What it looks like:
Solitary play Birth-2 years	Children play alone, with their own toys. They do not get close to or interact with other children. Solitary play should be encouraged because it builds skills for working independently.
Parallel play 2 ½ to 3 ½ years	Children continue to play on their own, but they are beside children and may be using the same toys.
Associative play 3-4 ½ years	Children begin to truly play with others. They share play materials but may be following their own story line.
Cooperative play 4-5 ½ years	The highest level of social play where children play in groups and everyone is cooperating to achieve a common goal. This type of play involves negotiation among children. This happens when children change "roles" in the play and/or take turns making suggestions about the plot
Games with rules 6 + years	A part of cooperative play that involves winners and losers. These games involve child-controlled rules and are not the same as competitive games, like sports. These games show an understanding of the social rules in our culture.
Onlooker Play Birth +	When a child watches other children playing but makes no attempt to join in.

[Table 2-2] Mildred Parten's six different types of play

Source: https://childdevelopmentprograms.ca/elearning-modules/the-power-of-play/story_content/external_files/Developmental%20Milestones%20of%20Social%20Play%20and%20Sharing.pdf

2) Peter Gray's 6 different types of play

Peter Gray's "Free to Learn" highlights the following different types of play and why they are important to development. These types of play are not separate entities – children can be engaged in several of these types of play all

at the same time. In playing, children have the opportunity to practice skills, learn and grow from even the most basic play experiences (Table 2-3).

Type of play	What it looks like:
Physical play	Whenever children engage in running, jumping, spinning, chasing or roughhousing, they are working on physical play
Language play	Children use their voices, sounds and eventually words, invent new words, practice rhymes for entertainment purposes
Exploratory play	Desire to understand or learn about new things
Constructive play	When children build something or work to produce some structure they have created in their mind, they are engaging in constructive play.
Fantasy play	When children take on a role during their play
Social play	When children engage in social play they are required to practice important social and life skills like communication, compromise, cooperation, problem-solving, turn-taking and self-expression.

[Table 2-3] Peter Gray' s 6 different types of play

Source:https://www.canr.msu.edu/news/the_power_of_play_part_3_types_of_play

2.3.3 Children' s play and nature place

David Sobel, a place-based educator, identified a set of play themes that emerge when children experience free time in nature. His book including: Childhood, and Nature: Design Principles for Education; Children's Special Places: Exploring the Role of Forts, Dens, and Bush Houses in Middle Childhood; Wild Play: Parenting Adventures in the Great Outdoors. The principles are not linked to any specific developmental age but will appear differently as the child grows older. His 7 Design Principles for Children and Nature is (Table 2-4):

Principles	Explanation
Adventure	Sobel notes, "Environmental education needs to be kinesthetic, in the body. Children should stalk, balance, jump and scamper through the natural world. Activity with a physical challenge component speaks directly to children via the mon/body link."
Fantasy and Imagination	Sobel notes, "Young children live in their imaginations. Stories plays, puppets show, and dreams are preferred media for early childhood. We need to structure programs like dramatic play, we need to create simulations in which students can live the challenges rather than just study them. A stage, boat, puppet theater or props are attractive for children "
Animal Allies	Sobel notes, "If we aspire to developmentally appropriate science education, then the first talk is to become animals, to understand them from the inside out, before asking children to study them or save them."
Maps and Paths	Sobel notes, "Finding shortcuts, figuring out what' s around the next bend, following a map to a secret event. Children have an inborn desire to explore local geographies. Developing a local sense of place leads organically to a bioregional sense of place and hopefully a biospheric consciousness."
Special Places	Sobe notes, "Almost everyone remembers a fort, den, treehouse, or hidden corner in the back of a closet. Especially between ages eight and eleven, children like to find and create places where they can hideaway and retreat into their own found or constructed spaces."
Small Worlds	Sobel notes, "From sandboxes to dollhouses to model train sets, children love to create miniature worlds that they can play inside of. Through creating miniature representations of ecosystems, or neighborhoods, we help children conceptually grasp the big picture. The creation of small worlds provides a concrete vehicle for understanding abstract ideas."
Hunting and Gathering	Sobel notes, "From a genetic perspective, we are still hunting and gathering organisms. Gathering and collecting anything compels us; searching for hidden treasure or the Holy Grail is as recurrent mythic form. Look at the success of 'Where' s Waldo' . How do we design learning opportunities like treasure hunts? "

[Table 2-4] 7 Design Principles for Children and Nature

2.3.4 Other theories practiced in Environmental Education

1) The loose part theory

In any environment, both the degree of inventiveness and creativity, and the

possibility of discovery, are directly proportional to the number and kind of variables in it. (Nicholson, 1971). The affordances and variables inherent in loose parts invite children to discover on their own leading to decision-making and problem solving. The child is actively involved when playing with loose parts. The way the materials will be used is up to the child, not a toy manufacturer, parent or teacher. The child is active, and the materials are passive until they are acted upon. When children engage with loose parts (Figure 2-4, 5) they are playing in many different ways (Diane Kashin, Ed.D, RECE, 2018).



[Figure 2-4,5] Loose parts kit example

source: <https://tecribresearch.wordpress.com/2018/09/09/playing-with-loose-parts-thats-how-learning-happens/>

2) Age-mixed play theory

Peter Gray has another theory called Age-mixed play. Some kinds of learning happen best when kids aren't segregated by age. Age-mixed play is more conducive to children's learning than is age-segregated play. Peter Gray said: A typical group playing together might consist of half a dozen children ranging in age from 4 to 12, or 8 to 15, in which groups the older children were often responsible to care for the younger ones⁸⁾.

8) "Some kinds of learning happen best when kids aren't segregated by age. " , < Tocaboca >Peter Gray, Ph.D. <<https://tocaboca.com/magazine/mixed-age-play/>> (2020. 06. 29).

2.3.5 Fine motor skill and gross motor skill for childhood development

Fine motor skill activities involve manual dexterity and often require coordinating movements of the hands and fingers with the eyes; this is called hand-eye coordination (McGlashan, H. L. et al, 2017). Activities that might improve fine motor skills include picking up objects with tongs, building with blocks, and doing craft projects (Dosman, C.F. et al., 2012). Gross motor skills are movements that involve large muscle groups and are generally more broad and energetic than fine motor movements. These include walking, kicking, jumping, and climbing stairs. Some milestones for gross motor skills also involve eye-hand coordination, such as throwing or catching a ball (Table 2-5) .

Age	Fine Motor Skills	Gross Motor Skills
3	Can draw a circle after being shown an example Can cut a piece of paper in half Can fasten and unfasten large buttons	Throws a ball to an adult standing five feet away Runs without falling Rides tricycle using pedals, unassisted by an adult
4	Can touch the tip of each finger to the thumb Can use a fork correctly Can get dressed and undressed without help	Walks upstairs by alternating feet Runs smoothly with changes in speed Catches a ball with arms and body
5	Grasps a pencil correctly Copies a triangle shape Can cut out a circle Ties shoelaces	Hops on one foot Performs jumping jacks and toe touches Walks up and down the stairs while carrying objects Catches a ball with two hands
6	Builds a small structure with blocks Can put a 16 to 20 piece puzzle together Uses a knife to cut food Cuts well with scissors	Jumps over objects 10 inches high Rides a bicycle with training wheels Throws with accurate placement Kicks rolling ball

[Table 2-5] Fine motor skill and gross motor skill for childhood development

Source: <https://www.verywellfamily.com/what-are-motor-skills-3107058#citation-3>

2.3.6 Summary

Summarizing the above theories, we can know that the cognitive development difference between the early and middle childhood lies in the development of logical thought ability, which determines whether children can infer to general principles in special events when they receive environmental education projects. With the growth of age, children's play behavior will gradually improve. The type of play are Observation, Adventure, Fantasy and Imagination, Animal Allies, Maps and Paths, Special Places, Small Worlds, Hunting and Gathering, Language Play, Constructive play, Social Play. By understanding the rules of playing in the natural environment, we get a lot of specific game forms and many natural elements from the natural world, which provide loose kits for children. Take forest as an example, there are loose kits like leaves, pinecones, ect.

2.4 Case Study

2.4.1 FEE programmes in urban forest

2.4.1.1 Tama Forest Science Garden

The Tama Forest Science Garden of the Forestry and Forest Products Research Institute was originally established in 1921 as a forestry experiment station by the Imperial Forestry Bureau of the Imperial Household Ministry. The Garden is located at the outskirts of Tokyo. To deepen general understanding of forest study, some research facilities have been opened to the public since 1992, including Cherry Tree Preservation Forests and Arboretums (15ha) and the Forest Science Museum. This botanical garden covers an area of 15 hectares, with Japanese fir, pine, Quercus based Natural Forest waiting for visitors. There are more than 1400 cherry trees in the park. In 2011, FFPRI formally established

a research agenda for environmental education in forest. Since then, Tama Forest Science Garden has served as a focal point to connect forest science and people. In 2019, those activities were awarded as Top 10 in Global Best Practice in Forest Education Competition launched by UFRO as a part of events held in International Forest Day and World Wood Day in Austria in March 2019. Forest education activities in Japan has 40 varieties are classified into 13 categories:

- “ 1. Immersion in nature: playing, games, walking
2. Resting for health: viewing cherry blossoms or autumn leaves, resting body and mind
3. Wildlife protection: investigating, breeding, and managing the environment
4. Nature observation and learning: observing trees or animals, learning about natural environment, observing forest related facilities, observing forestry
5. Collecting for observation and learning: flora and fauna
6. Collecting gifts bestowed by forests: fuel wood, material for handicrafts, collecting food, fallen leaves for composting
7. Environmental management: repair or mowing of forest trails
8. Building facilities in forests: building cottage or hut, building tree house, making forest trail, making playground equipment
9. Forestry work: planting trees, cutting understory, pruning, thinning, mushroom cultivation, making charcoal
10. Making handicrafts: crafts using wood (Figure 2–6, 7)
11. Activities related to daily life: eating food collected from nature, camping, outdoor cooking
12. Artistic activity: creation, outdoor concert, exhibition of pictures or photos
13. Outdoor sports: hiking and mountain climbing, athletics, skiing, backcountry skiing, adventure course⁽⁹⁾.



[Figure 2-6, 7] The forest environmental education of Tama Forest Science Garden

Source: Mariko INOUE, "Forest Education in Japan Historical Review; Current Forestry Practices, Forest Management, and Wood Processing Education; and Future Expectations, 2020

2.4.1.2 Dreamland nature school in South Korea

Dreamland nature school. The school is located in Yeongdeungpo-gu, Seoul. It has been built for 11 years. Their philosophy is: "Happy children will become happy adults when they grow up. Good memories in nature will overcome suffering and pain, achieve their goals and live a happy life. So they put forward the idea that children should return to nature. Children are here every day in the process of looking for the game they want to play, thinking, making decisions and actions, children understand the way of their lives. "Self leading life" is not cultivated through education, but naturally created when they play in the nature. Children aged 0-3 focus on playing in nature. They picnic in the forest with their parents, share food with their friends, worship and play. For 3-7-Year-old children, it's a good time to integrate into nature. Feel the power of nature and life. They go outing in nature every day. Even if it rains or snows, they will go out unless the weather is harmful to their health. They turn objects in nature into

9) Mariko INOUE, Forest Education in Japan Historical Review; Current Forestry Practices, Forest Management, and Wood Processing Education; and Future Expectations, Tama Forest Science Garden Forestry and Forest Products Research Institute, March 16, 2020, p.12.

toys. Children are happy to tell stories about flowers, leaves and fruits, boulders, insects and other natural objects. Children's playfulness is created by nature. It can provide more wisdom than any toy or teaching aid. They also have garden management activities to develop children's correct understanding of food and nature. Children also have their graduation ceremony in the forest (Figure 2-8, 9).



[Figure 2-8, 9] Picnic for children aged 0-3, Vegetable plot management for aged 3~7

Source: [Figure 2-8] <https://dreamland2006.modoo.at/?link=6i4is531>

Source: [Figure 2-9] <https://dreamland2006.modoo.at/?link=64fvn379>

2.4.1.3 Lion International Forest School in Chian

Lion International Forest School is the first forest school in China. It was established using a private forest in 2015. For children aged 3-6. The forest covers an area of 7 ha, and the expert team of South China Agricultural University has surveyed the environment, vegetation and insects. Rich vegetation and insect records provide professional support for teachers and children to fully understand the forest. There are regular forest safety patrol everyday, so as to make 100% safety preparations for children and teachers to enter the forest. The core of the forest education here is to let children understand nature, fall in love with nature, love life and respect life. Through activate sensory organs of children (there sight, hearing, smell, taste and touch) to develop children's

desire to protect nature and environment and their awareness of ecological and environmental protection. Through forest education, children's teamwork, problem-solving ability, environmental awareness, innovation awareness, courage and self-confidence are all improved. They have 3 types of courses:

1) 600 hours ($\times 3$) "life" in the forest

Here children will experience fire making in the forest, learn to plant, and observe nature.

2) Humanities and Arts Center

Here are 600 hours ($\times 3$) manual creative course and 600 hours ($\times 3$) humanities course. Children operate equipment, explore science and design clothes in the manual creative park. Children will experience music and create art in the center of Humanities and arts. There are also climbing areas, slides, sand playground and stages.

3) Touring study course

170 hours ($\times 3$) of touring study. Lion International school also practices boundless education. Children can experience different fields in more than 100 touring study bases to get in touch with real social scenes and learn social skills.

2.4.2 FEE for different age group

2.4.2.1 Pigman's detectives- FEE for early childhood in Latvia

Pigman (Figure 2-10) is the main "super-hero" of the eco-programme "Pigman's detectives" created JSC "Latvia's State Forests" that teaches everybody: "Don't litter the forest! You'll turn into a pig!". During the five years of programme's existence, more than 20 000 children of Latvia have been directly involved. In 2019, around 4000 children from all over Latvia are committed to become Pigman's detectives.

The ecoprogramme “Pigman’s Detectives” is based on “learning by doing” about forest and forest products. It focuses on four themes: 1) Dirty secrets of the forest; 2) Let’s trace the Pigman in the forest; 3) Forest in the Toy box; 4) Let’s grow the Oxygen. With the help of specially designed on-line and board games, dance and songs, fairy tales, different types of visualisation (such as Pigman dolls and other materials) children perform certain tasks of a detective to assess the good and the bad things that happen in the forest. Each theme is built according to the principle: See, Hear, Listen, Do, which also foresees an active involvement and participation of children in different fun-classes. In the second year of the programme, children are encouraged to go outdoors in the forest to discover and explore the forest in all seasons.



[Figure 2-10] Pigman’s detectives- FEE for early childhood in Latvia

source:<http://forestpedagogics.eu/portal/2019/11/22/pigmans-detectives-programme-is-globally-recognizes-as-one-of-the-best-practicies-in-forest-education/>

2.4.2.2 Forest 101- FEE for middle childhood in South Korea

In 2016, A program called 「FOREST 101」 (Figure- 11, 12) was planned for teenagers with the objective of introducing them to regular school curriculum. This forest education project is sponsored by Korea Forest Welfare Institute. It

was selected as the winner of “Top 10 in Global Best Practices in Forest education Competition”¹⁰⁾ launched by IUFRO¹¹⁾ in March 2019.

“The program is composed of 3 steps, the first to become intimate with a forest and motivated for forest education, the second to learn and feel elements of a forest and the third to solve contemporary problems of forest with friends and classmates. For 14 weeks, students experienced the forest regularly and became intimate with nature; they could increase self-esteem and happiness by getting rid of anxiety and forming amicable relationships. The achievement of ‘FOREST101’ became acknowledged by many educators and school authorities and as a result was included into 2018 regular school curriculum ”¹²⁾.



[Figure 2-11, 12] The forest environmental education in South Korea Forest 101 Project.

Source: <https://www.iufro.org/science/task-forces/forest-education/outstanding-practices-forest-education/#c28422>

10) In total 71 proposals from 23 countries from all continents were received. The best activities were selected by the competition board using predefined criteria – pedagogical quality, novelty of the practice and practical effectiveness.

11) The International Union of Forest Research Organizations (IUFRO) is a non-profit, non-governmental international network of forest scientists, headquartered in Austria. The organization unites over 15,000 scientists in about 700 Member Organizations] from more than 127 countries. It’s mission is to promote international cooperation in forest research and related sciences. IUFRO enhances the understanding of the ecological, economic and social aspects of forests and trees. It disseminates scientific knowledge to stakeholders and decision-makers and contributes to forest policy and on-the-ground forest management.

12) “ FOREST 101 – SOUTH KOREA – MIDDLE SCHOOL ” , < INTERNATIONAL UNION OF FOREST RESEARCH ORGANIZATIONS>,
<<https://www.iufro.org/science/task-forces/forest-education/outstanding-practices-forest-education/#c28422>> (2020. 06. 29)

2.4.2.3 FEE programme co-working with universities Mexico

Young forest entrepreneur reforestamos. This program motivates the youth to develop entrepreneurial ideas to address their region's socio-environmental and economic problems from a forestry perspective by helping the youth to understand the potential of the forests in order to contribute to their sustainable development. The program is hosted by Panorama¹³⁾. This project provides opportunities for participants to connect with advisors who will help them to improve their proposals and to increase the impact of their entrepreneurial efforts in the forests (Figure 2-13).

“ Each year, the best entrepreneurial ideas are rewarded in an event that connects the youth with strategic actors from the private sector, the government, and civil society. The program started in 2013 in four Mexican universities. Currently, around 100 universities (all of which offer forestry degrees) from eleven Latin American countries take part in this event and more than 6,000 students (mainly from rural areas) and 200 teachers participate”¹⁴⁾.



[Figure 2-13] Young forest entrepreneur reforestamos

source:<https://panorama.solutions/en/solution/young-forest-entrepreneur>

13) PANORAMA – Solutions for a Healthy Planet is a partnership initiative to document and promote examples of inspiring, replicable solutions across a range of conservation and sustainable development topics, enabling cross-sectoral learning and inspiration.

14) “ EMPRENDEDOR FORESTAL – YOUNG FOREST ENTREPRENEUR REFORESTAMOS – MEXICO – TERTIARY To ”, < INTERNATIONAL UNION OF FOREST RESEARCH ORGANIZATIONS>, <<https://www.iufro.org/science/task-forces/forest-education/outstanding-practices-forest-education/#c28422>> (2020. 06. 29)

2.4.3 Summary

Through the study a basic programme list which is practices ground the world can be summarized as below. There are 32 programmes of 8 type. (Table 2-6). The case studies also showed some mechanism and operations methods of an FEE programme.

1) Phase are necessary in a regular programmes. For example, the first stage is to get close to nature, the second stage is to understand natural plants, and the third stage is to carry out group tasks in the forest.

2) Many foreign forest education activities are supported by national forest welfare departments, such as the cases of the United States, Lithuania, South Korea, Japan, etc. There are also have some supported by non-profit organizations like the case in Mexico, etc.

3) Using the value of forest can provide college students with the opportunity to start a business.

4) Use cartoon characters or experience that are easy to accepted by children in a FEE program. For example, Pigman detective project in Lithuania. Pigman appeared in many hot social activities to attract children's attention, which has had a good effect on propaganda. Also the forest 101 project in South Korea, which imitates the name of the most popular TV program 'Producer 101'.

FEE program type	Specific
Immersion in nature	Barefoot walking/ viewing blossoms or autumn leaves/
Art and Imagination	Forest cinema/ Draw the clouds (Make up a cloud story) /Snowground art/ outdoor concert/ exhibition of pictures or photos/Draw the clouds, Make up a cloud story/ Making hand crafts using wood
Game and sports	Hiking/ skiing/ adventure game
Identifying and learning the value of forest	From the shape of its leaves to the texture of its bark/ Use Moss to Find Your Way / Forest meditation / Learning About Fossils / Identifying Rocks/
Identifying and learning to protect Insect and animal protection	Identification of insects and birds/ Tracking Wildlife/ Wildlife protection knowledge/ (hardware: bird watching tower)
Collection	Forest treasure hunt/ Play the rainbow hunt game/Collect objects for an art collage/
Construction	Garden management/ building wooden bridges / Press leaves and flowers/Create a rock garden/ building cottage or hut
Special activities for environmental protection	PIGMAN-Environmental Education character/learning the Dirty secrets of the forest

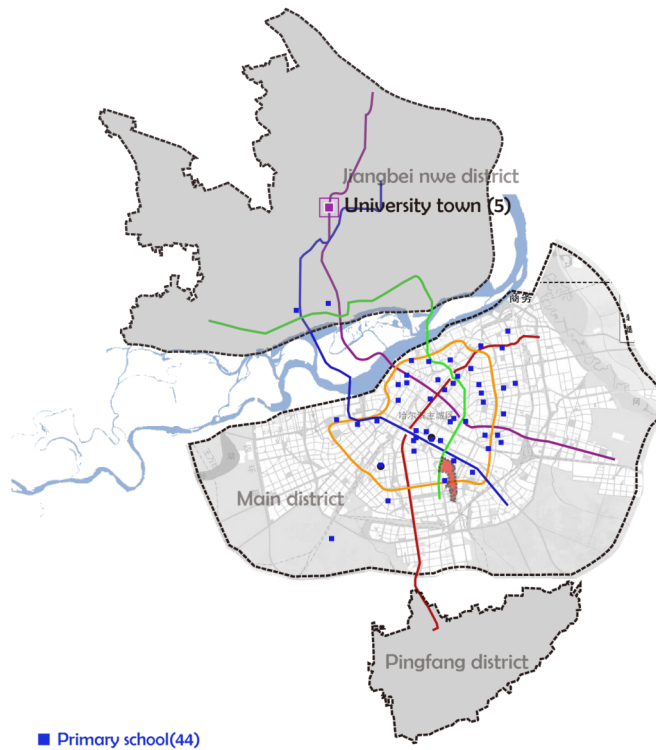
[Table 2-6] 32 programmes of 8 type

Chapter 3 Analysis on Users and Site Conditions

3.1 Analysis of Users

3.1.1 Distribution of schools in Harbin

In China, Children in elementary school is ages 7 to 13; and children in Kindergarten ages 3 to 6. Untill 2019, there are 2244 primary schools and 489000 students in Harbin (Guo Yidi, 2019). The follow figure shows the partial elementary schools in the main districts (Figure3-1).



[Figure 3-1] Location of partial Harbin primary schools

3.1.2 Curriculum and class arrangement of elementary school in Heilongjiang Province

China has been practicing 9years' compulsory education for many years, National curriculum is developed and designed by experts and technical forces organized by the state. The curriculum arrangement for Grade 6 of primary school is as the table (Table 3-1). Local curriculum is organized and developed by local education administrative departments and School curriculum is school-based and determined by the school itself. So the Local curriculum and School curriculum can be combined with the FEE programme. The programme of FEE also has the potential possibility to combine with curriculum, such as natural science and arts. According to the constitution of our country, Art starts since the first grade of primary school, and the natural science curriculum is started at grade 3.

Curriculum and class arrangement of compulsory education in Heilongjiang Province (Elementary school only)							
National Curriculum	grade	1	2	3	4	5	6
	Morality and life	1	1				
	Morality and society			2	2	2	2
	Chinese	7	7	7	7	7	7
	Mathematics	5	5	5	5	5	5
	English			2	2	2	2
	Science			2	2	2	2
	PE	3	3	2	2	2	2
	Music	2	2	2	2	2	2
	Arts	2	2	2	2	2	2
	Comprehensive practice			4	4	4	4
	Local courses	3	3	1	1	1	1
	School curriculum	3	3	1	1	1	1
total		26	26	30	30	30	30

[Table 3-1] Curriculum and class arrangement of compulsory education in Heilongjiang Province (Elementary school only)

source: <https://wenku.baidu.com/view/61a4c47fa417866fb84a8e91.html>

3.1.3 Activities targeting elementary school students in HFBG

Every year, there are two regular events in the botanical garden, one is the “Science and Technology Activity Week” and the other is “Bird-Loving Week”. They are all in May. In terms of program form, it’s almost the same every year. Generally speaking, the science popularization objects of these two activities are citizens, but there are still activities for only children. For example, in the “Science and Technology Activity Week” there are exhibitions, handicrafts, parent-child tree planting activities, etc. And in the “Bird-Loving Week” there are quiz and bird loving theme painting activities.

1) the “National Forestry Science and Technology Activity Week “

Since 2001, the third week of May is designated as “National Science and Technology Activity Week” in China. Although this event is not entirely aimed at children, still have some activities like exhibition, handwork, Plant planting experience activities. And every year on the opening day of the Science and Technology Activity Week, It open a free for one day to all students, including elementary school students. In 2007, the theme was “Protecting beautiful homes and Building green harmony“. It introduced the occurrence and control methods of forest diseases and insect pests in Heilongjiang Province. Students from Harbin Pearl school participated in.



[Figure 3-2] Students from Harbin Pearl school

Source: http://www.gov.cn/govweb/jrzg/2007-05/21/content_621465.htm(2020.06.29)

In 2015, the “National Forestry Science and Technology Activity Week 2015”, sponsored by the State Forestry Administration, was officially launched in Heilongjiang Forest Botanical Garden. The theme of this activity is: enjoy the beautiful forest scenery and popular science. On May 16 the activity was officially launched in the living collection garden. More than 20000 students from, elementary and secondary schools, and universities such as Northeast Forestry University, Harbin University of Technology Green Association, and the public participated in the activity. The theme of 2017 science and technology activity week is “embracing nature and sunshine action - experts take you to know tulips”. On the day of the activity, the park is open to university, middle school and elementary school students for one day free. Some experts introduced the brief history of tulip cultivation in the forest botanical garden. The science popularization volunteers also distributed color origami for children, and explained how to use it to make a beautiful tulip. In 2019, Heilongjiang Forestry and grassland Bureau and Heilongjiang Forest Botanical Garden jointly held science and technology activity week again. They publicized and demonstrated the importance and necessity of protecting the ecological environment to the citizens by setting up a consultation platform, hanging banners and slogans, placing more than 40 publicity boards, and distributing publicity materials. Teachers and students from Northeast Forestry University were invited to explain and distribute souvenirs, parents and children were held to cultivate plants together. The atmosphere was active and the enthusiasm of the children was fully aroused.

2) “Bird-Loving Week”

Heilongjiang is located in the northernmost part of China, and the weather is relatively cold. In Heilongjiang Province, April is the season of bird migration, and

may and June are the season of migratory bird breeding. Therefore, the time of “bird week” is usually at the end of April and the beginning of May. Heilongjiang Province is one of the key forest areas in China, which is located in the center of the migration channel of migratory birds in Northeast Asia, and is also an important breeding habitat for birds. Heilongjiang Province is rich in bird resources. There are 361 species of birds, accounting for 28% of the national bird species. Among them, there are 11 species of Red Crowned Crane and Chinese merganser under the first level national protection, and 56 species of Swan and white pillow crane under the second level national protection. Taking good care of birds is conducive to maintaining ecological balance. The “Bird-Loving Week” originated in 1981 and was originally set up to protect the migrating birds between China and Japan. The regulations on the protection of terrestrial wildlife approved by the State Council in 1992 determined the “bird loving week” in the form of laws and regulations.

On May 13, 2018, the 37th “bird loving week” in Heilongjiang Province was held in Heilongjiang Forest Botanical Garden with the theme of “protecting bird resources and protecting green water and green mountains”. This bird loving week is jointly sponsored by Heilongjiang Provincial Forestry Department, Heilongjiang Wildlife Conservation Association, Heilongjiang Provincial Forestry Society, Heilongjiang Provincial Forest Resources Supervision Commissioner Office of State Forestry Administration, Northeast Forestry University, World Wide Fund for nature (WWF), Harbin Forestry Bureau, etc. It was organized by College of wildlife and protected area in Northeast Forestry University. After the ceremony, there was an off-site interactive programmes, the elementary and secondary school students’ bird loving theme painting competition, quiz on bird

knowledge, and gave photography to children¹⁵⁾.



[Figure 3-3] 2016 bird loving week

Source: <https://wildlife.nefu.edu.cn/info/1064/1235.htm> (2020.06.29)

3.1.4 Questionnaire investigation on social needs

The purpose of this questionnaire is to know the social needs and suggestions of Harbin citizen for FEE programme. There are 93 questionnaires in total were collected. The results show that:

- 1) 88.2% of people who are investigated are aged 20-40 years old. 50.5% of them are parents. 80.3% of these parents have children in kindergarten. 14.8% have children in elementary school. 4.9% have children in junior high school. 77.4% of them take their children to the botanical garden 0-2 times a year.
- 2) 11.8% of the respondents are workers or student engaged in education. 6.5% of them are government workers. 6.5% is Community workers.
- 3) 52.7% of them are living in the main districts of Harbin, and 47.3% are in the close suburbs.
- 4) 44.1% thought their children have several times a week playing in the natural

15) “保护鸟类资源 守护绿水青山——黑龙江省第37届“爱鸟周”活动仪式隆重举行”, <Collage of Wildlife and Protected Area >, 2023.06.05., < <https://wildlife.nefu.edu.cn/info/1064/1235.htm> > (2020.06.29)

environment. 29% thinks at least once a day. 16.1% think several times a month, 10.8% is several times a year.

5) 89.2% of the respondents thought it necessary for children to receive environmental education.

6) 89.2% of the people thought that the forest resources in HFBG is valuable for developing FEE programme for children after knowing what environmental education is.

7) 87.1% of the respondents thought that if it's possible, it is necessary to integrate the FEE programmes of HFBG with curriculums of surrounding schools.

8) 33% of them have taken their children to participate one of the 2 programmes of HFBG ("Bird-Loving Week" and "National Forestry Science and Technology Activity Week"); 26.9% of them hope to participate, and 15.1% of them don't know about the activities.

In subjective questions, they showed the reason why they agree with the FEE programmes in HFBG, their concerns and the suggestions.

Reason of agreements:

1. This kind of programme can set their children free from the frame of school, and can help the young children to explore who they are.
2. Some said they have been too busy to play with their children, so it might be a good opportunity to have some parent-child time.
3. It's good for children to take part in activities and get close to nature

Concerns:

1. Time of the programme, because their children are too busy with study. If the FEE is organized by school they will agree their children to join.

2. If it is financially affordable.
3. Children in kindergarten are too early to participate the programme.
4. The HFBG is too far away from their home.

Suggestions:

1. Combine with the current topics which are interesting to children
2. More humanized facilities for children.
3. Carry out quarterly programmes
4. Cooperation with primary and secondary schools
5. Let the common people be in the target group

3.2 Analysis on institutions of Existing EE programmes

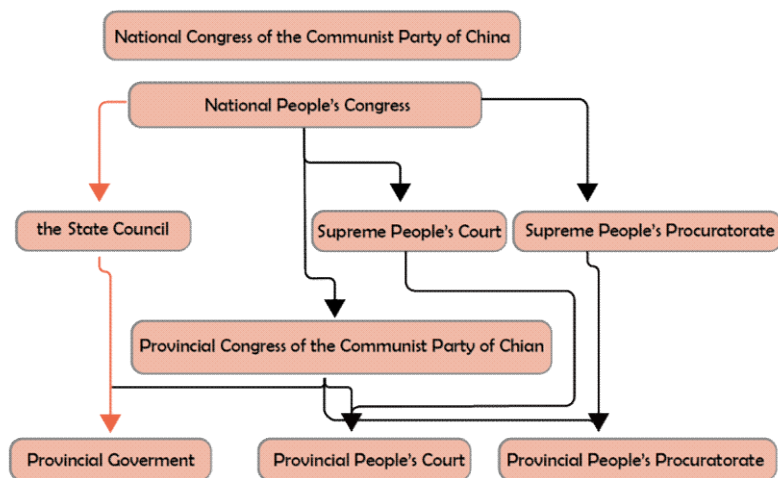
3.2.1 Organizers of existing programmes

In the two regular events of Heilongjiang botanical garden: the “Bird-Loving Week” and “National Forestry Science and Technology Activity Week “ , the organizers involves: Heilongjiang Provincial Forestry Department, Northeast Forestry University, Harbin Forestry Bureau, Heilongjiang Provincial Forest Botanical Garden, China (Harbin) forest museum, etc.

3.2.2 Affiliated institutions of Heilongjiang botanical garden

The forestry departments in China refer to the administrative and public institutions that have the obligation and responsibility of administration and guidance for the national forestry production and construction. Its specific composition is the State forestry and grassland Bureau under the leadership of the Natural resources Ministry which is a component of the State Council, the

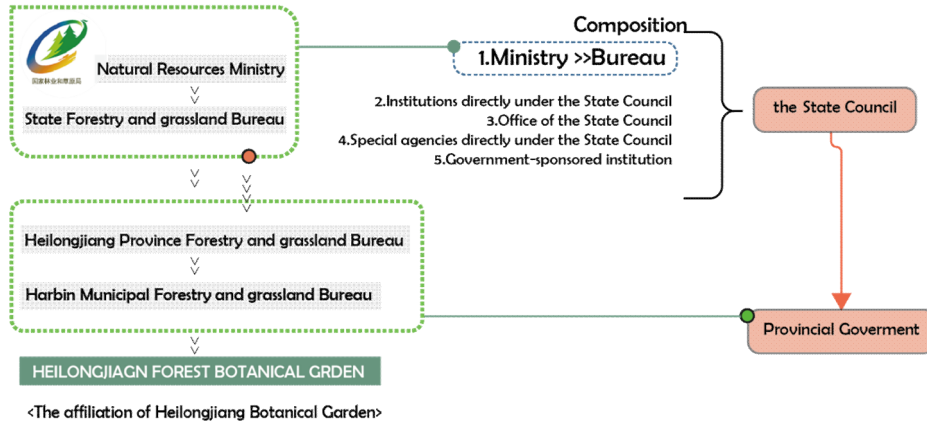
forestry and grassland departments (bureaus) set up in each province and autonomous region, the county and municipal forestry and grassland bureaus and the Township Forestry workstations(Figure 3-4, 5). Its main responsibilities are to do research and formulate policies and policies for forest ecological environment construction, forest resource protection and land greening, organize and draft relevant laws and regulations and supervise the implementation, etc¹⁶⁾.



<Organizational structure of the government>

[Figure 3-4] Diagram of National government agencies

16) “林业主管部门” <<https://baike.baidu.com/item/%E6%9E%97%E4%B8%9A%E4%B8%BB%E7%AE%A1%E9%83%A8%E9%97%A8/6024853?fromtitle=%E6%9E%97%E4%B8%9A%E9%83%A8%E9%97%A8&fromid=15951937&fr=aladdin>>(2020.06.29)

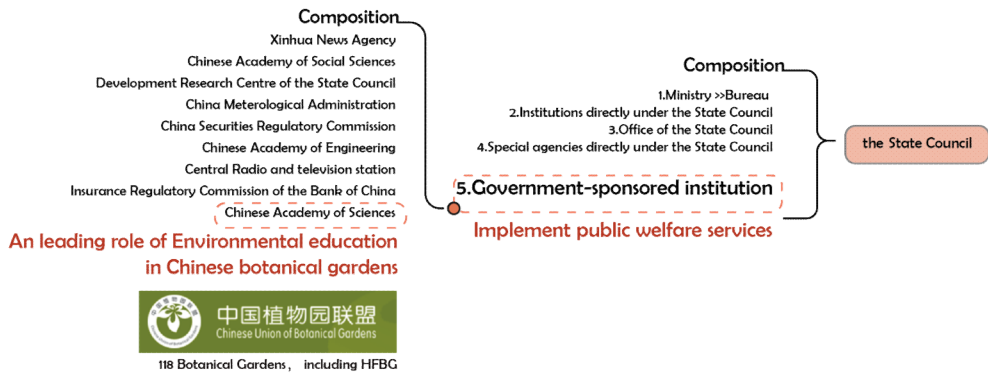


[Figure 3-5] Composition of administrative department in charge of HFBG

3.2.3 Environmental education related institution

According to the case study, many foreign forest environmental education projects are managed by the State Forestry Department, such as the program “Children’s forest” in the United States hosted by the United States Department of Agriculture- Forest service; “Forest 101” program in South Korea hosted by Korea Forest Welfare Institute. the “Pig-man detective” for children’s forest environmental education in Lithuania, and the Tama forest science garden’s education program managed by the Forestry and Forest products Research Institute lead by Imperial Forestry Bureau of the Imperial household Ministry in Japan. However, there is no national department related to forest welfare in China now. Among the five components of the State Council, there are four types of administrative departments and one is Public institutions. Public institutions are the departments that implement certain public welfare services of the government, and are social service organizations. Among the nine components of the public institutions, the Chinese Academy of Sciences (Figure

3-6) took the lead in establishing the Chinese Union of Botanical Gardens¹⁷⁾.



[Figure 3-6] Environmental education related institution

At present, Chinese Academy of Sciences manages 15 Botanical Gardens (including those jointly managed by local governments), with a total area of 68319.7 hectares, accounting for 67% of the total area of botanical gardens in China(Jiao Yang, 2019). Guided by the botanical garden of the Chinese Academy of Sciences, China's botanical garden has achieved good social benefits in promoting scientific education for primary and secondary schools, winter and summer camps, research practice, environmental education research, and

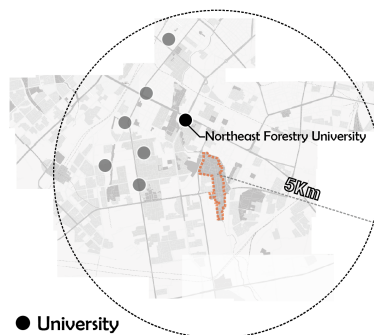
17) The Chinese Union of Botanical Gardens (CUBG), sponsored by Chinese Academy of Sciences(CAS), National Forestry and Grassland Administration(NFGA), Ministry of Housing and Urban-Rural Development(MOHURD), Ministry of Ecology and Environment(MEE), is a public organization for strategic cooperation among Chinese botanical gardens and arboreta. It is built at the initiative of seven relevant institutes and organizations of China. These are Botanical Garden Committee, CAS, the Chinese Association of Botanic Gardens, the Committee of Chinese Association of Parks, the Ex-situ Conservation Committee of China Wild Plant Conservation Association, the Plant Environment and Diversity Committee of Chinese Society for Environmental Sciences(CSES), Botanical Gardens Committee of China Biodiversity Conservation and Green Development Foundation(CBCGDF) and the East Asia Botanical Gardens Network(EABGN). Based on the principle of voluntary, CUBG will unite all the members, by advancing the standard construction and orderly development of Chinese botanical gardens, to achieve reasonable distribution `species resource sharing and technological exchanges and cooperation. This will have an important and far-reaching impact on promoting the system establishment and innovation ability of Chinese botanical gardens, as well as serving the ecological civilization development and innovative country.

Botanical Garden scientific education and environmental education activities. Heilongjiang Forest Botanical Garden is also in the Chinese Union of Botanical Gardens.

3.2.4 Surrounding Universities

1) Northeast Forestry University (NEFU)

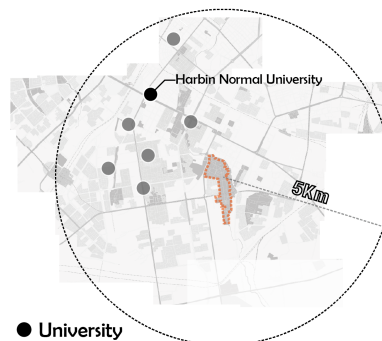
In the past “Science and Technology Activity Week” , professors and students of Northeast Forestry University highly participated in on-site activities. Explain forest science to visitors, especially for children, and distribute souvenirs at the site. And the Northeast Forestry University is located on the side of the botanical garden(Figure 3-7). The superiority of geographical location provides a good potential support for the forest environmental education programmes of the garden in the future. NEFU is presently a multidisciplinary university with forestry as its leading field and offers a unique specialization in forestry engineering. China (Harbin) forest museum, located in Wenbo building of Northeast Forestry University, is the first museum with forest theme in China. The exhibition area is about 11000 square meters.



[Figure 3-7] Location of Northeast Forestry University (NEFU)

2) Harbin Normal University (HRBNU)

It was founded in 1946. It is the center of teacher training on Chinese International Promotion, higher teacher education, higher education in arts, educational science and research and teacher training in Heilongjiang Province. There is a normal school in Harbin, and it is close to the botanical garden (Figure3-8). Although there is no subject related to forest education here, as students of normal university they know children better than other majors. So Harbin Normal University can also be a potential cooperative institution to implement the environmental education program. Normal university students can not only participate in the activities as organizers, but also fully exercise their professional skills of getting along with children.



[Figure 3-8] Location of Harbin Normal University

3.2.5 Summary

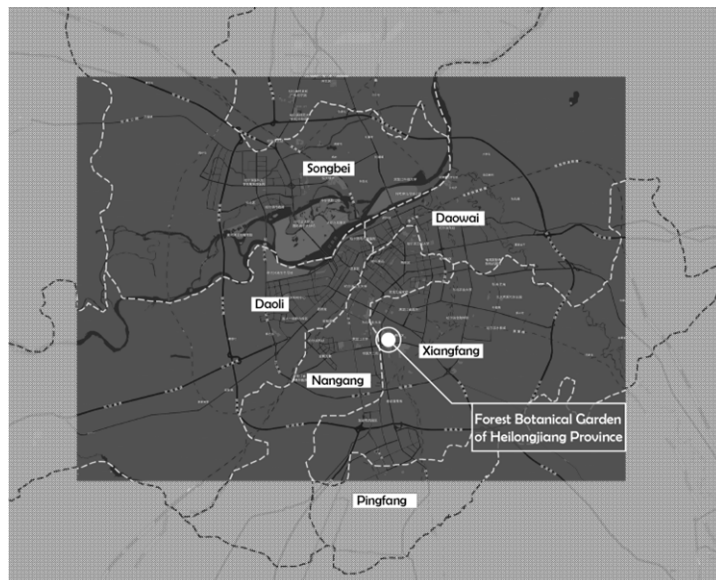
Although the two regular activities in Heilongjiang forest botanical garden every year are hosted by Heilongjiang Forestry and grassland Bureau, the management organization of the botanical garden. However, through the investigation, it can be said that its scope of responsibility does not include the implementation of environmental educations. Therefore, the cooperation of various social sectors

may be a feasible way under the premise of the long-term forest environmental education activities in the botanical garden. For example, the Chinese Academy of Sciences, which attaches great importance to the practice of environmental education, the Northeast Forestry University, which participate in every regular activity of the botanical garden as an assisting position, and the Harbin Normal University are also good potential partners.

3.3 Analysis on the Surrounding Conditions

3.3.1 Position and general situation of Harbin

Heilongjiang Forest Botanical Garden is located at No. 105, Haping Road, Xiangfang District, Harbin City, covering an area of 136 hectares, with its center at $126^{\circ} 16' \text{E}$ and $45^{\circ} 45' \text{N}$ (Figure 3-9). It is located in the cold temperate zone, which belongs to the semi humid continental climate.

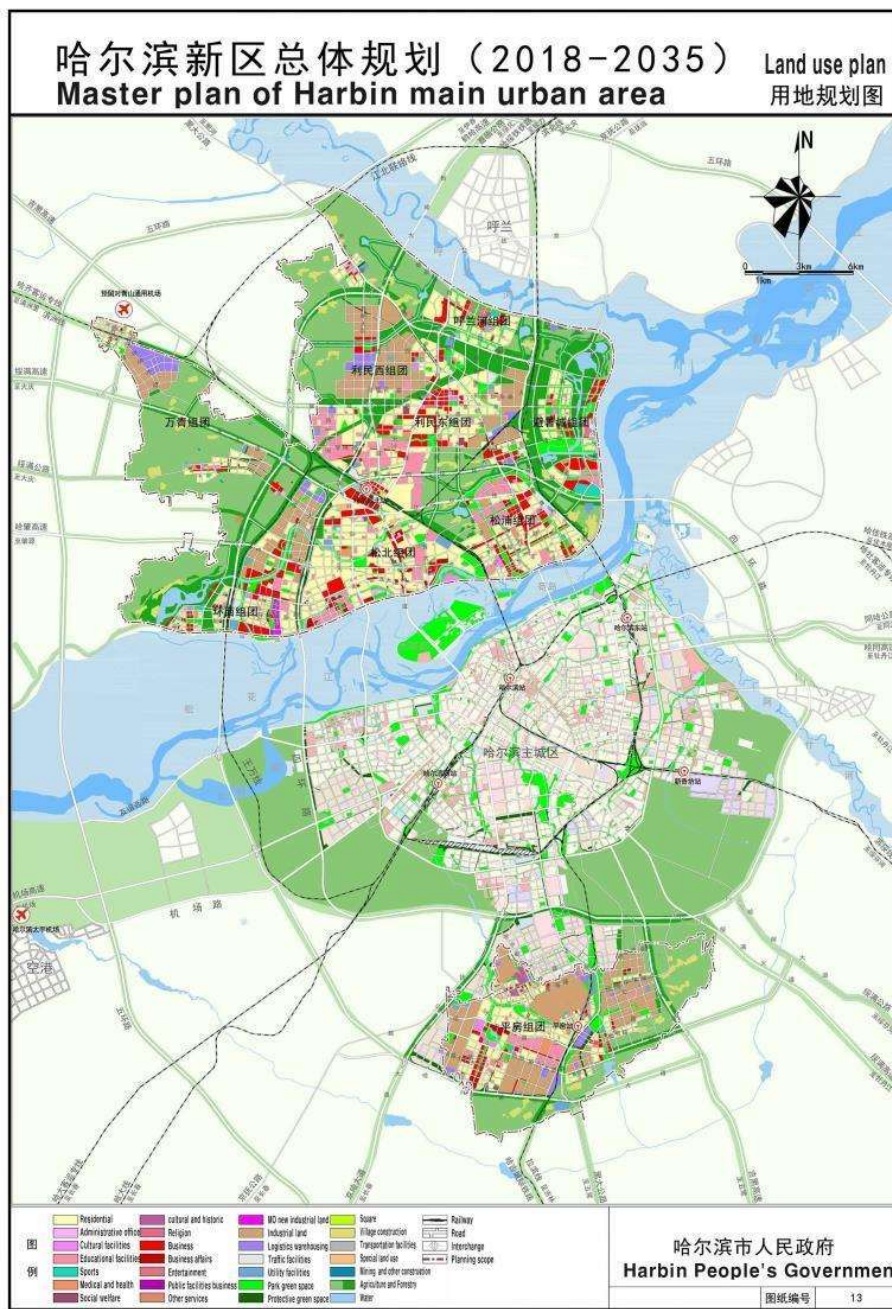


[Figure 3-9] Position of HFBG in the main districts

Harbin, referred to as “ha” for short, is the capital of Heilongjiang Province, the sub provincial city, the core city of Harbin metropolitan area, and the important central city and national important manufacturing base in Northeast China approved by the State Council(Reply of the State Council on the overall urban planning of Harbin). As of 2018 (Figure 3-10), the city has nine districts, seven counties and two county-level cities under its administration, with a total area of 53100 square kilometers, a built-up area of 435.28 square kilometers, a permanent population of 10.858 million, a urban population of 7.09 million, and a urbanization rate of 65.3%(Heilongjiang Harbin national economic and social development statistical bulletin, 2018).

Due to the Siberian high and its location above 45 degrees north latitude, the city is known for its cold weather and long winter. It is considered to be an ice city, as winters here are dry and freezing cold, with a 24-hour average in January of only -17.6°C (0.3°F), although the city sees little precipitation during the winter and is often sunny. Spring and autumn constitute brief transition periods with variable wind directions. Summers can be hot, with a July mean temperature of 23.1°C (73.6°F). Summer is also when most of the year’s rainfall occurs, and more than half of the annual precipitation, at 538 millimetres (21.2 in), occurs in July and August alone¹⁸⁾.

18) “Harbin” ,<[https://en.wikipedia.org/wiki/Harbin#:~:text=Under%20the%20K%C3%B6ppen%20climate%20classification,cold%20weather%20and%20long%20winter.X\(2020.06.29](https://en.wikipedia.org/wiki/Harbin#:~:text=Under%20the%20K%C3%B6ppen%20climate%20classification,cold%20weather%20and%20long%20winter.X(2020.06.29)



[Figure 3-10] Master plan of Harbin main urban area

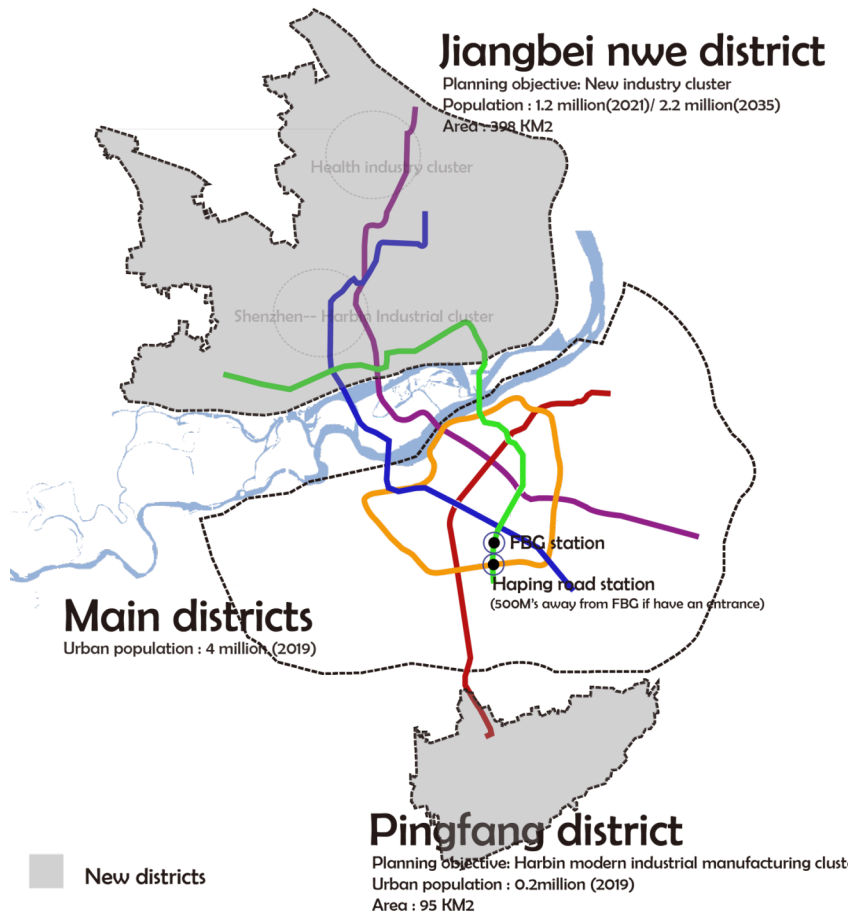
Source: http://www.harbin.gov.cn/art/2019/11/27/art_21349_816949.html (2020.06.29)

It has been 70 years since the founding of new China, and Harbin's economy and society have achieved considerable development. From 2003, 2010 urban map and 2018-2035 planning map released in 2018, it can be clearly seen that Harbin has been developing continuously in the past 20 years. The future of Heilongjiang Forest Botanical Garden, which is located in the center of the city, is also full of opportunities(Figure 11).



[Figure 11] The expansion of Harbin Downtown area(2003, 2010, 2018~2035)

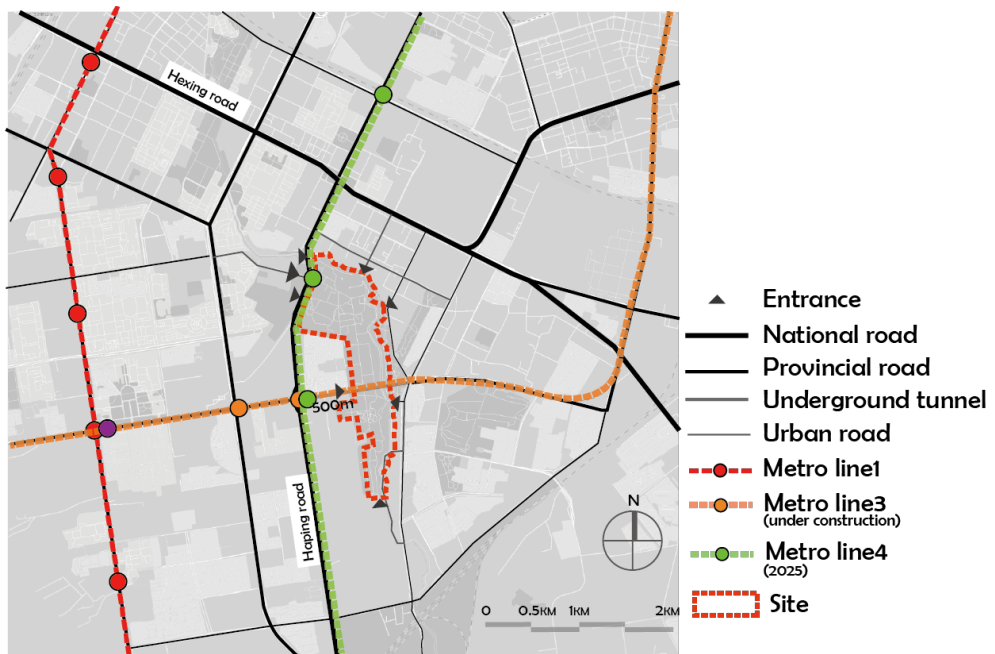
Also, with the construction of public transportation(line 3,4,5), the botanical garden will face great opportunities.It will connect all the railway stations, scenic spots and universities in Harbin, According to the urban planning of 2018-2035, the metro line connects the old and new urban areas, and it is easy to reach the botanical garden(Figure 3-12).



[Figure 3-12] The public transportation

3.3.2 Accessibility

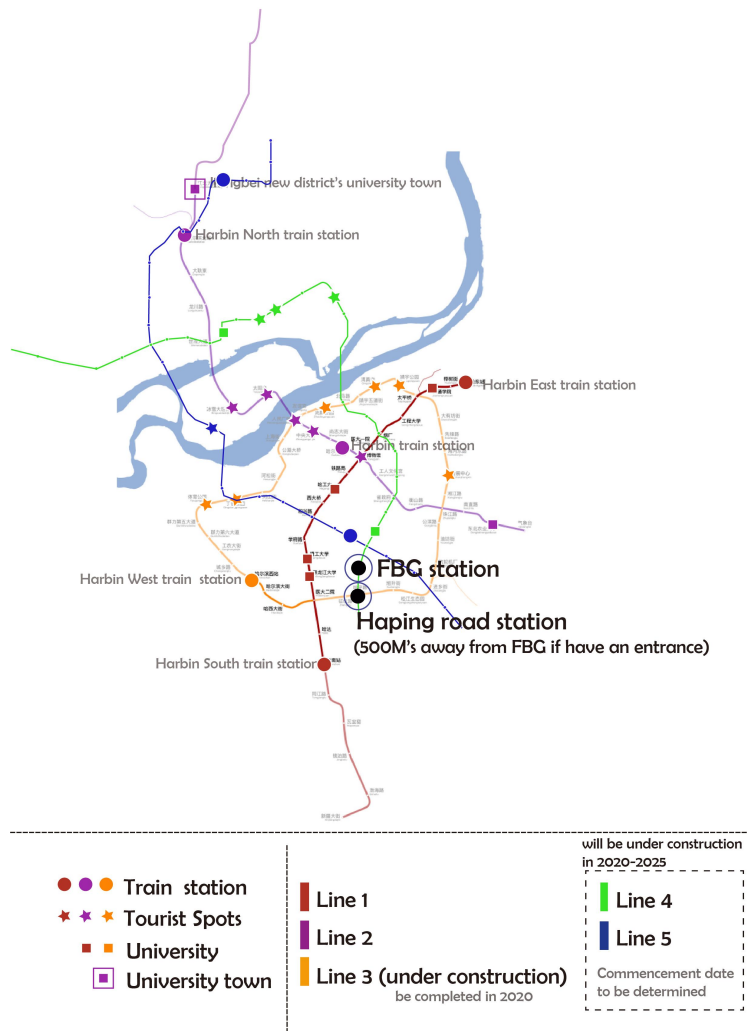
The botanical garden has 7 entrances in the north and East side. The way to get to the botanical garden is by car or by bus. Now there are nine bus lines to get here: No.28, 51, 67, 69, 81, 209, 121, 217, 338. A parking lot is on the north side. Now the subway line 3 is under construction. The subway line 3 passes through the underground part of the central part of the botanical garden and is expected to be completed in 2020. After completion, there will be a subway station with a straight line distance of 500 meters from the botanical garden, called Haping station. But the botanical garden has no entrance on the west side(Figure 3-13).



[Figure 3-13] Accessibility

Metro Line 4, line 5, is under planning. Now it is planned to start construction. It is estimated that the completion time will be 2025. There will be a station to the

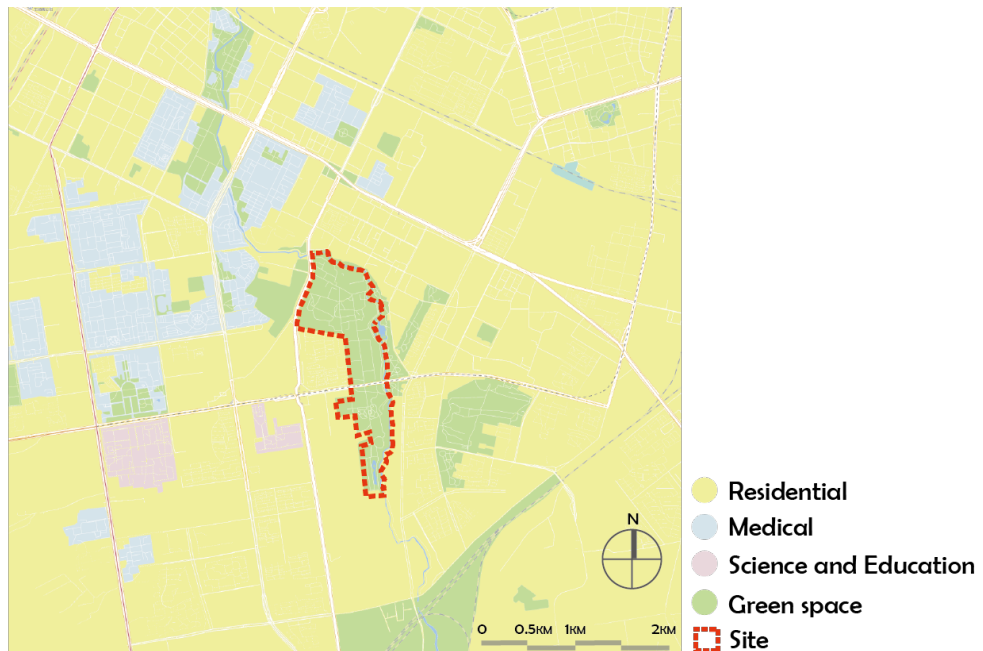
main gate of the botanical garden, Botanical garden station, when Metro Line 4 is completed. After the completion of Metro Line 3, 4 and 5, almost all railway stations, sightseeing spots, universities and Harbin new area will be connected, and the accessibility of Harbin forest botanical garden will be greatly improved(Figure 3-14).



[Figure 3-14] Near future accessibility

3.3.3 Surrounding situation

According to the Surrounding land use map(Figure 3-9), there are many residential land, scientific research and education land, and medical land around the botanical garden. Also, It can be seen from the main facilities around the botanical garden that there are seven major universities, four major hospitals, (three of them are the highest level hospital in China) within 5000 meters from the forest botanical garden(Figure 3-15).

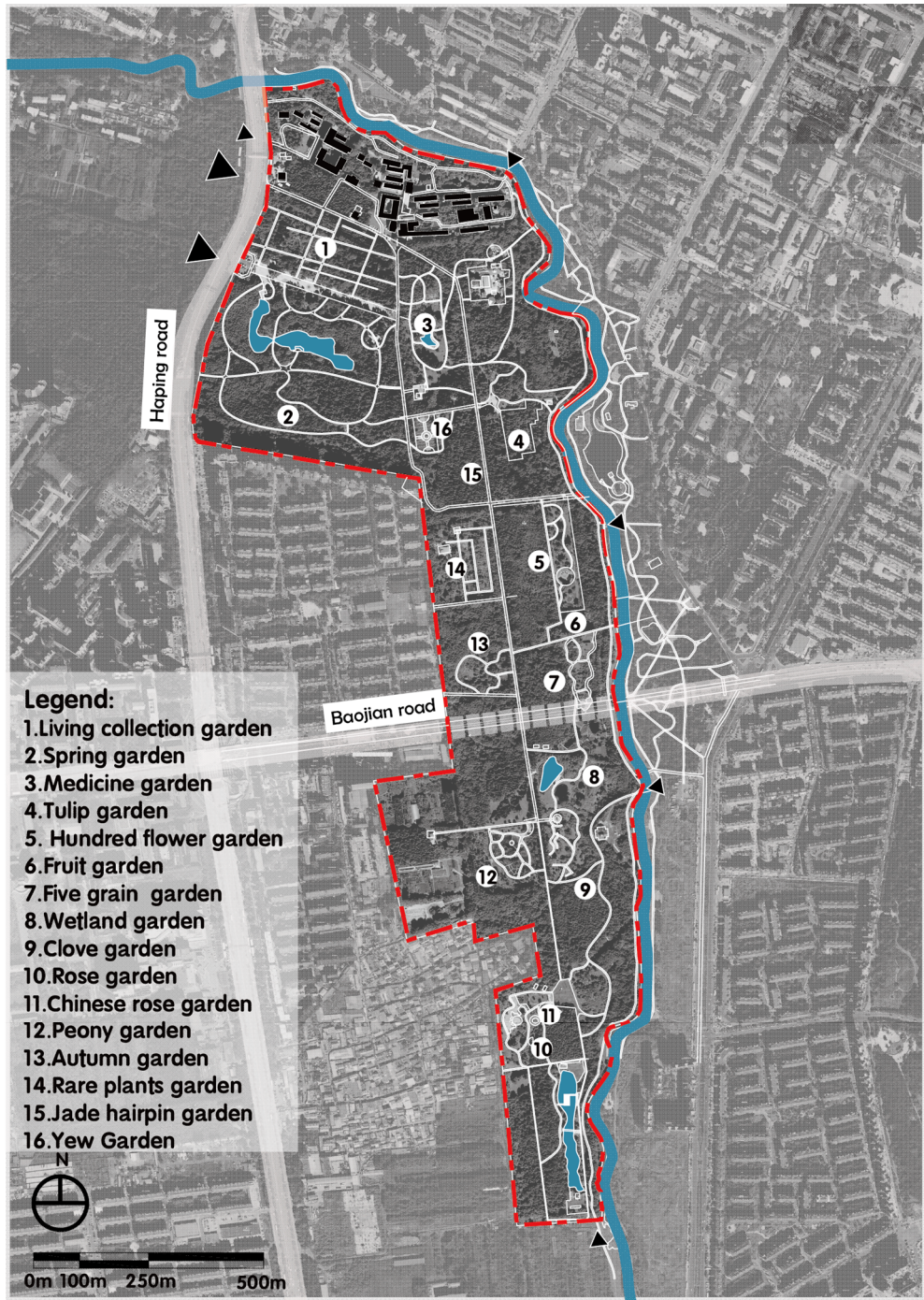


[Figure 3-15] Surrounding land use

3.4 Analysis on the current planning

3.4.1 Current planning

Area is 136 hectares and the forest coverage rate of the whole garden can reach 88%. The whole garden is divided into two parts by Haping road. The west part is birch forest belt and the nursery stock center of the botanical garden is closed to the outside world. The open area is the east side of Haping road. There are 16 special gardens(Figure 3-16): Herbarium garden, Spring garden, Medicine garden, Tulip garden, Hundred flower garden, Fruit garden, Five grain cognitive garden, Wetland garden, Clove garden, Rose garden, Wei garden, Peony garden, Autumn garden, Rare plants garden, Rose garden, Jade hairpin garden, Yew garden. 11 scenic spots: Ecological leisure square, Yuanzhong lake, Qingyun tower, Scissors garden (amusement park), Memorial garden, Wedding garden, Lotus lake, Changshou mountain, Huaguo Mountain, Lotus pond, and Landscape park. Among them, the Rare plants garden is the internal scientific research base of the botanical garden, which is not open to the public. In addition, the botanical garden belongs to the category of Forest Park, there is a large number of plant woodlands in the garden as the purpose of maintaining the ecological microclimate of the botanical garden, which has not yet been developed into a scenic area.



[Figure 3-16] Current planning

3.4.2 Current landscape structure

The center of the botanical garden is a three kilometer long central axis. This axis organizes the viewing areas on both sides. In addition to the ornamental area, the botanical garden also has scientific research area, management area and residential area, which are not open to visitors (Figure 3-17). The main ways to visit are bicycles and sightseeing buses.



[Figure 3-17] Current land use



[Figure 3-18] Current Landscape type

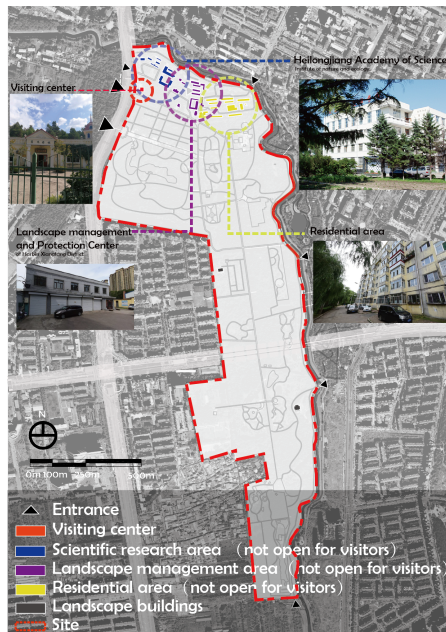
3.4.3 Current Landscape type

There are three types of landscape space: dense forest space, Sparse forest space and grassland. Dense forest space is a space formed by dense trees; Sparse forest space is a space composed of forests and other landscape elements in a certain area; open space is a landscape created by lawn or low arbor, ground cover plants, ornamental flowers, etc. The main land use types and area ratio of forest botanical garden are dense forest (55.7%), sparse forest

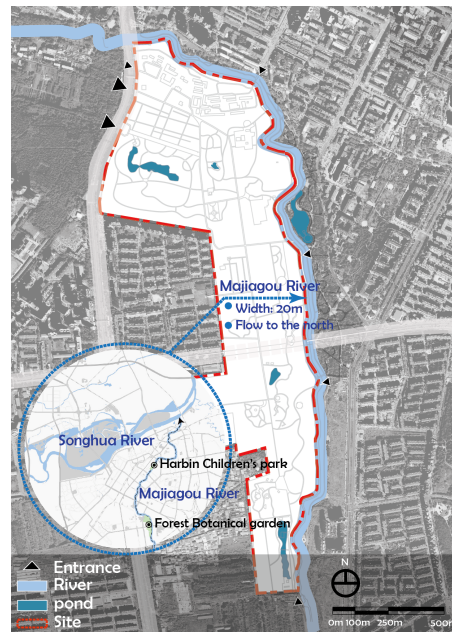
(23.2 %), grassland (8%), water (2.7%), building (2.1%), hard paved area (8.3%);
The air is fresh and humid, with good ecological environment(Figure 3-18).

3.4.4 Building Condition

There are scientific research buildings, management buildings and residential buildings in the botanical garden. The height of them is less than 7 floors, and not be opened to the visitors. The buildings open to the visitors include the visiting center in the main gate and some landscape buildings in the botanical garden(Figure 3-19).



[Figure 3-19] Buildings



[Figure 3-20] Water system

3.5 Nature resources

3.5.1 Soil type

The terrain of this area belongs to the plain area with slight undulation, and the

terrain decreases radially and slowly from southwest to northeast. The altitude is 136-155m, and the soil is medium chernozem. It is suitable for plant growth (Zhang Shuo, 2008).

3.5.2 Water system

Next to the botanical garden, there is a river, Majiagou river(Figure 4-19). Majiagou River, a tributary to the south of Songhua River. It originates in the hilly area in the west of Acheng District of Harbin. It flows through four districts of Harbin downtown area and flows into Songhua River after passing through three scenic spots (Zoo, Children's Park and Forest Botanical garden), The total length is 44.3km.The length through the downtown area is 34.7km. It is 20-100 meters wide and covers 240 square kilometers and mainly supplied by natural rain (Figure 3-20).

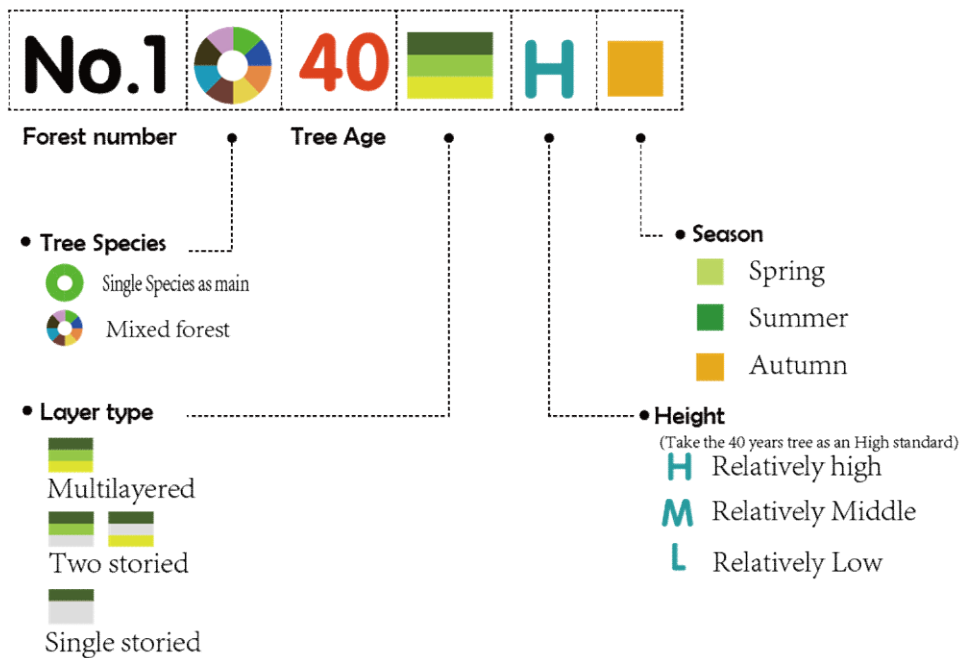
In 2004, Majiagou river was seriously polluted. The pollution was caused by the waste of nearby residents. The polluted Majiagou river flowed into the botanical garden from the south, and lead to more than 100 precious trees dead. In the south of the botanical garden, there was a disgusting smell, especially in raining days, more sewage flowed into the botanical garden. Now the water quality is back to normal. There are four waters in the forest botanical garden, with an area of 10103m², 617m², 2322m², 7704m² (from north to South).

3.5.3 Plants resources

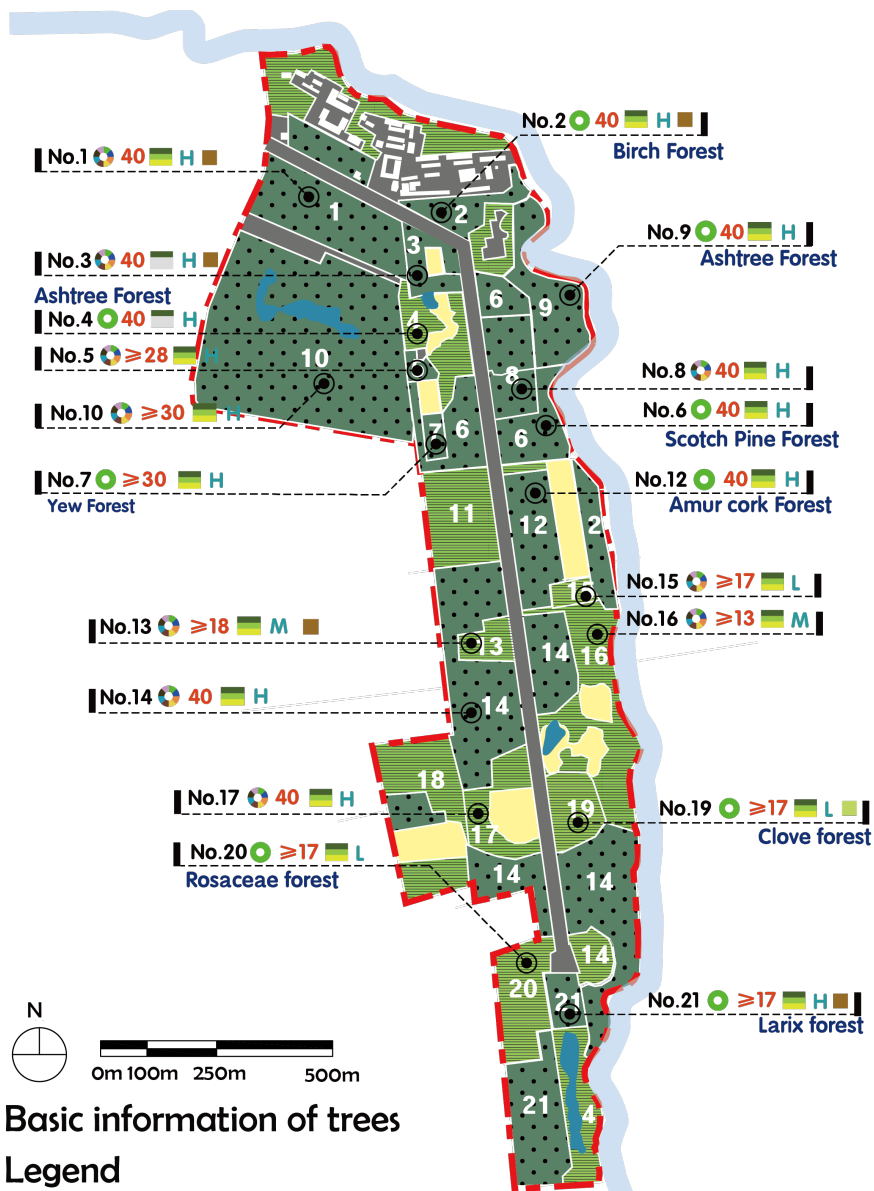
The woody plants in the whole garden are classified according to their ornamental types. The highest proportion is 83 species that only ornamental flowers, accounting for 34.7% of all plant species; The lowest proportion is color

leaf tree, accounting for only 2%. 37 species can see both flowers and fruits(15.5%), 36 species with appreciable fruit (15.1%), 19 autumn leaf species(7.9%), 18 evergreen species(7.5%)(Feng shunan, 2018).

Through previous researches related to Forest Botanical Garden in Heilongjiang Province, extract the information of tree species, tree age, forest level, density, height, viewing season. Then to make these information readable, a set of signs are designed to master the necessary forest information of this huge botanical garden. So it can be a basic information for design of environmental education programmes(Figure 3-21, 22).



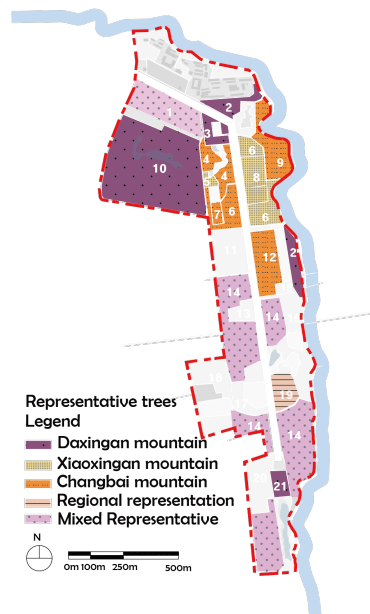
[Figure 3-21] Symbol of basic forest information



[Figure 3-22] Basic forest information

3.5.3.1 The Representative forest distribution analysis

Its forest resources are abundant, accounting for 80% of the botanical garden's area. As a forest botanical garden located in the city center, it is of great significance to the study of plant germplasm resources, the protection of plant diversity, the popularization of plant knowledge and the sustainable development of plant resources in northeast China. Here are Siberian silver birch representing Daxing'an forest, Manchurian Ash representing Changbai Mountain Scots pine and representing Xiaoxing'an forest. These trees are in good condition in Heilongjiang Forest Botanical Garden. Most of them are 15-20 meters high and over 40 years old(Figure 3-23, 24, 25).

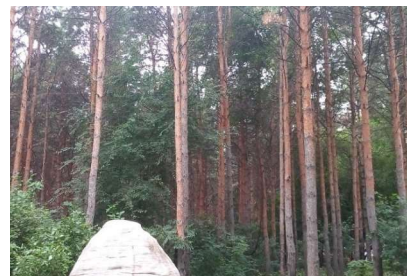


[Figure 3-23] Basic forest information



[Figure 3-24] Siberian birch forest

Source:<https://youimg1.c-ctrip.com/target/100t07000002n41aB6EF.jpg>(2020.06.2.29)



[Figure 3-25] Scots pine

Source:<https://youimg1.c-ctrip.com/target/fd/tg/g3/M07/C4/31/CggYGIXHPC2AUKaLAAOdHWVhHoU372.jpg> (2020.06.29)

3.5.3.2 Seasonal forest distribution analysis

1) Spring: Clove garden (Figure 3-26)

Clove garden, it covers an area of 1.5 hectares, about 25 varieties, such as *Syringa oblongata*, *Syringa fragrans*, *Syringa Hungarian*, *Syringa orchida* were introduced and planted in this garden. There are purple, white, yellow, pink color flowers. The inflorescence of flower is mostly large panicle. Lilac is a famous ornamental aromatic tree species and also the representative flower of Heilongjiang Province. It blooms from April to May every year, attracting a large number of tourists.

2) Summer to Autumn: Fruits garden, Birch forest and Larix forest

Fruits garden, located in the east of Heilongjiang Forest Botanical Garden, is adjacent to Hundred flowers garden and Grains garden. It covers an area of 2 hectares. It was opened in 2003. It mainly introduces and cultivates various ornamental plants and melon plants. There are more than 60 varieties of pear, catalpa, hawthorn, saponatum, Sardinia, apricot, all red apple, cherry, etc. The garden is built with an arc-shaped cane rack corridor. Lianas such as gourd and loofah are snaking up.

Birch forest and larch forest are another great autumn landscape in the botanical garden. They are located in the north and south of the botanical garden respectively. They also represent the magnificent autumn scenery of the forests in northern China.



[Figure 3-26] Seasonal forest distribution analysis

3.5.3.3 Aromatic forest analysis

Among the woody plants in botanical garden, there are 26 kinds of aromatic plants. Among the 26 fragrant woody plants, except magnolia, the other 25 are *Syringa* of Oleaceae family. Most of the plant species of *Syringa* have fragrant smell, which is a major feature of the genus. The flowers can also be used to extract essence. In addition, lilac is a good material for landscape design because of its elegant flowers and unique fragrance. At present, there are many new varieties such as *Syringa vulgaris* 'Chun Ge' and *Syringa vulgaris* 'Albo-plena' in Heilongjiang Forest Botanical Garden. Oleaceae family plants are planted in clove garden, covering an area of 1.5 hectares. Lilac is the representative flower of Heilongjiang Province. It blooms from April to May every year, attracting a large number of tourists.



[Figure 3-27] Aromatic forest analysis



[Figure 3-28] Clove garden
Source: <http://cvbg.iplant.cn/hljfbg/pano>

3.5.3.4 Anion forest analysis

The Anion produced by the ionization of air by the photoelectric effect formed by the discharge of forest trees, leaf branches and Photosynthesis of green plants. Especially fruitful in (Cupressaceae) trees. According to the previous research, the Living collection garden is the most fruitful of anion.



[Figure 3-29] Anion forest analysis

Source: Li Jiashan, 2016 ¹⁹⁾

3.5.4 Animal resources

Butterfly habitat analysis

Through the observation of two scholars Huang Fengmei and Luo Zhiwen, from May 2008 to September 2009, a total of 31 species of butterflies in 6 families were found here. Among the species they collected, *Papilio maack*, Black-veined white, Green-veined white, Asian comma, Short-tailed blue

¹⁹⁾ Li Jiashan, Distribution of negative air ions in functional area, 城市森林公园空气负离子时空分布特征研究, P40, Fig.5-6

were the dominant species. The istribution of butterflies in Heilongjiang Forest Botanical Garden is directly related to the ecological environment and the diversity of plants, which results in the regional distribution of butterflies. For example, the living collection garden is a multi-layer forest structure, there are various woody plants like camphor pine, *Platycladus orientalis*, yellow pineapple, *Fraxinus mandshurica*, etc, and flowers such as *Hosta* are planted. Here is a good habitat for butterflies(Figure 3-30). So large green belt crested butterflies are often seen here flying and mating on the tree crown. In addition, during the opening period of more than 100 kinds of herbaceous flowers in Hundred flowers garden, such as fluke, iris, *Petunia* and *Hemerocallis*, butterflies also increased dramatically²⁰⁾.



[Figure 3-30] Butterfly habitat analysis

20) Huang Fengmei, Luo Zhiwen, 黑龙江省森林植物园蝶类种类及发生量变化研究, “Seasonal Changes of Butterflies in Heilongjiang Forest Botanical Garden”, *Forest By-Product and Speciality in China*, vol. 2, 2011, p59.

3.6 Forest culture resources

3.6.1 Birch and northern nomadic culture

Nomads in northern China like Hezhe (赫哲族), Elunchun (鄂伦春) people use birch bark to make utensils, utensils for food, hunting tools and boats. Scholars call this special culture birch bark culture. Birch Bark products are called birch bark crafts (Figure 3-31). Birch bark kettle is made of birch bark as the main raw material. It is made by hand with fine workmanship, simple design, different styles, natural color, novel and unique. It is one of the unique crafts in China. It is flexible, easy to shape, water-proof, anti-corrosion, moisture-resistant, durable and easy to carry. Birch boats are narrow and long, generally less than 1 meter wide and about 5 meters long. It is made of pine board with two raised skeletons, and the bottom and side of the boat are made of large birch skin without holes. Instead of using a single iron nail, pine wood is cut into nails to reinforce various parts. This kind of boat can take two or three people and row with a single oar. It is very quiet when rowing, so it's good for approaching prey and capturing wild animals. Birch boats are portable. One person can lift a boat easily.



[Figure 3-31] Northern Nomadic Story with Birch
<http://hlj.people.com.cn/n2/2017/0129/c220024-29652998.html>

In the early summer of each year, birch has a large amount of water, which is the season when people in Elunchun (鄂伦春) peel birch. They select the thick, straight and smooth birch, use a knife to cut a circle at the upper and lower ends of the trunk, and then cut a knife vertically between the upper and lower ends, and tear it off slowly with both hands along the edge of the knife, and the whole rectangular birch skin will be peeled. Next year, the tree will be able to produce new birch bark.

Elunchun (鄂伦春) In June 2008, the birch kayak production technology of the Oroqen nationality in Daxinganling region of Heilongjiang Province was listed in the first batch of national intangible cultural heritage expansion projects. The Hezhe(赫哲族) people in Northeast China still use such artifacts. Hezhe nationality is mainly distributed in the three river plain formed by the confluence of Heilongjiang, Songhua River and Wusuli River And Wanda mountain. According to the sixth national census, the population of Hezhe nationality is 5354 (Heilongjiang Statistics Bureau, 2019). According to relevant historical records and unearthed cultural relics, Hezhe(赫哲族) as a family first appeared in March of the second year of Kangxi (1663).



[Figure 3-32] Northern Nomadic Story with Birch

Source: https://www.sohu.com/a/341660587_99966965, <https://touch.travel.qunar.com/youji/5629836>,
http://www.chinann.com/chinese/orogen/Bircskin_list.aspx

3.6.2 Clover and the history of Harbin

In September 1896, according to the relevant provisions of the Sino Russian secret treaty and the contract for joint operation of the East Provincial Railway Company, the Russian government called “Dongqing road” as a section of railway in China from Chita in Russia to Vladivostok via Manchuria, Harbin and Suifenhe in China(Figure 3-33).



[Figure 3-33] The Chinese Eastern Railway

<https://zh.wikipedia.org/wiki/%E6%9D%B1%E6%B8%85%E9%90%B5%E8%B7%AF>

Clover was once called “the flower of the Russian aristocracy” because it was open in the aristocratic Manor. At the end of the 19th century, a large number of Russian engineers and technicians, workers, their families and overseas Chinese came to Harbin. They brought Russian culture and customs from Russia, as well as some exotic trees and flowers. At that time, the Russians living in Xiangfang district, Nangang district and Daoli district had lilac flowers in their small yards. Cloves made Harbin city lovely, and also added fun and memories to people living in the city.

In recent years, in order to highlight the characteristics of the city, and give full play to the role of cloves in improving the urban environment and landscape, Harbin city has been exploring to expand the number of cloves, increase the variety of cloves, improve the popularity of cloves and improve the effect of clove landscape, and has completed the “Plan of building a city with clove in Harbin”, combined with the “Green space system planning”, scientifically plan the layout of cloves to create a clove landscape with impact and shock. Cloves have been integrated into Harbin People’s life. Every May is the season for Harbin citizens to enjoy flowers. Relevant departments of Harbin City have drawn “Harbin lilac flower appreciation map 2019”, which provides authoritative flower appreciation guide for citizens and tourists. It recommends 84 characteristic Lilac Street roads, 34 characteristic lilac parks and 20 pedestrian lilac viewing lines.

Chapter 4 Programme Planning

4.1 Goal and Principle of the Programme

4.1.1 Goal of the Programme

Forest is the natural environment that people rely on for existence, which has social value and natural value. Forest is related to human health, improving human living environment, providing living resources and habitat. The goal of environmental education is to enable children to understand the northern forest through the activities which are suitable for their development, as well as the natural environment they live in. This programme of HFBG can be a start to stress the importance of forest education especially for children to realize sustainable forest utilization and conservation.

4.1.2 Different types of FEE Programmes for Different Age groups.

According to the analysis of children's development, children aged 3-6 are called early childhood, which is the age of kindergarten children in China. 6-12 years old is the middle childhood, and they are elementary school students. As we all know children are playing all the time. Playing is the main way for children to learn the world. Therefore, the summary of children's play behavior characteristics is very important for the form of environmental education programmes. The early and middle children have different behavior and cognitive development characteristics, which lead to different play behaviors. Generally speaking, play behaviors types of early childhood are: Cooperative play, Games with rules, Onlooker Play, Language play, Physical play, Pretend play. Play behaviors types of middle childhood are: Practice play, Pretend play, Games with

rules, Construction play. However, some scholars argued that mixed age group of children is helpful to learning. So some activities still need mixed age group. Age differentiation should not be too rigid.

4.1.3 Regular programme and Permanent programme

The programme of forest environmental education should be divided into permanent projects and regular projects. Permanent project is a form of exhibition in the botanical garden. All visitors can get the knowledge of environmental education showed in there. And regular projects need to have certain staffing, schedule, learning materials and other supports. Referring to cases abroad (Chapter 2), we can see that in regular projects, the programmes should be organised by phase. The depth and difficulty of environmental education should gradually increased. Therefore, it is proposed to organise regular education programs through two levels. The primary environmental education programmes are mainly aimed to let children get close to nature, feel nature and form a certain connection with nature, which is led by staff in the whole process. The main purpose of high-level programmes is for children to understand forest plants and the relationship between forests and people and through some simple or difficult activities that need group cooperation, let them directly establish a relationship with nature.

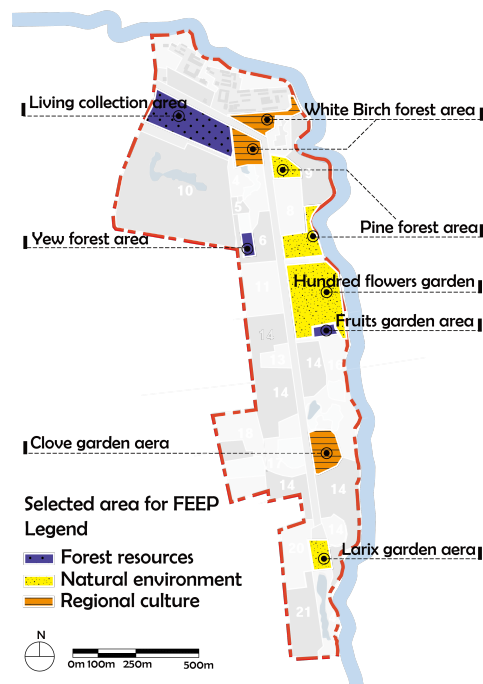
4.2 Structure of Programme Planning

According to the analysis of the previous chapter, it can be seen that the HFBG, the representative of the northern forest, has its regional representativeness (species of Xing'an Mountain and Changbai Mountain); there are also butterflies, squirrels and other animals to form the natural environment; and the northern forest has the representative life of the northern nomadic people; the lilac in this botanical garden can tell the regional history and culture of Harbin. Therefore, the content of forest education in HFBG should be classified into 3 component (Figure 4-1) :

component 1: Forest resources (use of forest products)

component 2: Natural environment (Forest environment, forest ecosystems)

component 3: Regional culture (Natural features, Regional culture)



[Figure 4-1] Selected area for FEFP

4.3 Education Content for each area

4.3.1 Living collection area

It is a concentrated exhibition area for the introduction of woody plants. More than 40 families and 300 kinds of trees, such as Korean pine, camphor pine, Changbai pine, yew, yellow pineapple, *Fraxinus mandshurica*, *Juglans mandshurica*, four seasons brocade, white cuttage, redbark spruce, clove, Magnolia, Acer, *Lonicera*, *Tripterygium wilfordii*, northeast elderberry, were introduced and planted in the park. There are many different shapes of leaves and different textures of bark, fruits. So this is a good area to know how to identify trees through activities related to leaves, and through the combination of various leaves, it can become a good art activity material (Figure 4-2).

Name	Spring leaves	Summer leaves	Autumn Leaves	Name	Spring leaves	Summer leaves	Autumn Leaves
White birch/白桦/작작나무				暖木条美莲/분꽃나무			
<i>Betula platyphylla</i> Suk.				<i>Viburnum burejaeticum</i> Regel et Herd			
朝鮮小葉/매자나무				千金榆/까치박달			
<i>Berberis koraiensis</i>				<i>Carpinus cordata</i> Bl.			
大花溲疏/그란디플로라말발도리				山皂角/주엽나무			
<i>Deutzia grandiflora</i> Bunge				<i>Gleditsia japonica</i> Miq.			
大字杜鹃/철쭉				山楂/산사나무			
<i>Rhododendron schlegelii</i> Maxim				<i>Crataegus pinnatifida</i> Bunge			
东北扁核木/빈주나무				水榆花楸/팔메나무			
<i>Prinsepia sinensis</i>				<i>Sorbus alnifolia</i>			
东北山梅花/고왕나무				松东锦鸡儿/황담초			
<i>Philadelphus schrenkii</i> Rupr.				<i>Caragana xusuriensis</i> (Regel) Pojark			
东北杏/살구나무				桃叶卫矛/참빗살나무			
<i>Prunus mandshurica</i>				<i>Euonymus bungeanus</i>			
短梗五加/오갈피나무				天女木兰/함박꽃나무			
<i>Eleutherococcus sessiliflorus</i>				<i>Magnolia sieboldii</i> K. Koch			
枫华/거제수나무				土庄绣线菊/아구장나무			
<i>Betula corymbosa</i> Trautv.				<i>Spiraea pubescens</i> Turcz.			
光叶东北茶藨子/까치발나무				西北栒子			
<i>Ribes mandshuricum</i> var. <i>subglabrum</i>				<i>Cotoneaster zabelii</i> Schneid.			
华北卫矛/송솔잎말미살나무				香茶藨子/까치밥나무			
<i>Euonymus maackii</i> Rupr.				<i>Ribes odoratum</i> Wendl.			
鸡树条美莲/백담나무				榛子/개암나무			
<i>Viburnum opulus</i> Lin. var. <i>calvescens</i>				<i>Corylus heterophylla</i> Fisch.			
李子/살구나무				美丽绣线菊/꼬리조팝나무			
<i>Prunus salicina</i> Lindl.				<i>Spiraea elegans</i> Pojark.			
毛樱桃/앵두나무				蒙古栎/신갈나무			
<i>Cerasus tomentosa</i>				<i>Quercus mongolica</i> Fisch. ex Ledeb.			
毛榛子/물개암나무				柠筋槭/복자기나무			
<i>Corvus mandshurica</i> Maxim				<i>Acer triflorum</i> Komarov			

[Figure 4-2] Different kinds of leaves

Source: (Feng Shunan, 2018)²¹⁾

4.3.2 White Birch forest area

China is a multi-ethnic country, and there are ethnic minorities living in every region. According to the analysis of the third chapter, we know that the life of nomadic people in northern China is closely related to birch forest. This kind of dependence between the primitive nation and nature is a very valuable cultural material. However, the minority culture in China is gradually influenced by the Han culture, which has gradually faded out of people's sight. For the new generation of children, such minority culture is very rare. However, if the potential value of this culture is educated through activities, it might be a good start for northern Chinese children to understand the place they live in. On the one hand, such teaching content should be very meaningful for protecting intangible culture.

Therefore, "Northern Nomadic Story with Birch " is proposed as environmental education content in this area. It is suitable for children to experience birch bark culture by handwork, or through permanent exhibition of birch bark cultural items. In addition, considering the language play (Chapter 2) of children, it can also be a good content to teach children how to speak the national language of these specific items.

4.3.3 Pine forest area

The utilization of resin is closely related to people's life. The Pine and the Ashtree are commonly used wood for furniture making(Figure 4-3), so it's easy to be seen in daily life. They are also the top-grade wood for building, bridge,

21) 黑龙江省森林植物园植物景观特征研究, Feng Shunan, "Study on the plant landscape characteristics of Forest Botanical Garden in Heilongjiang Province", 2018, Master Dissertation. Northeast Forestry University, pp.103-4.

sleeper and furniture. They have different textures which is fun to do comparison. *Fraxinus mandshurica* has a high reputation in the international market and has a price 4-5 times higher than that of coniferous tree species. The material is tough and compact, rich in elasticity, the texture is straight, the planed surface is smooth, which can be widely used in construction, aircraft, shipbuilding, instruments, sports equipment, furniture, etc. The material of Korean pine is light and soft, the structure is delicate, the texture is dense, straight and accessible, the shape and color is beautiful and not easy to deform, and it has strong anti-corruption ability.



[Figure 4-3] Different textures

Although there are no researches about the animal habitat in the botanical garden, according to the comments of domestic tourism websites, squirrels often appear in the pine forest in the botanical garden. There are two kinds of squirrels in the northeast China, one is the chipmunk, the other is the devil squirrels. Forest environmental education is not only for trees, but also for animals live in forest. So understanding squirrels is also an necessary educational content in this area.

As we all know, pine trees have a unique fragrance. The fragrance comes from the resin. Pine trees have a complete system of pipes running through the whole tree body, which botanists call resin channel. The resin channel is surrounded by a special layer of secretory cells. The secretory cells secrete turpentine in the process of physiological metabolism of pine trees, and transport it to the pipeline for storage. When a pine tree is hurt, the turpentine flows out of the pipe and seals the wound. Some substances in turpentine can also volatilize into the air, killing harmful bacteria. Resin can be used by many ways. Fossil resin is called amber. When it is still a soft resin, there may be small insects such as bees, ants and spiders trapped in it to become animal amber. They are finally well preserved and have great historical and scientific value. So the education content of pine is very extensive.

4.3.4 Hundred flowers garden area

Butterflies are especially lovely for children in the northren China. Perhaps much more seriously than children in other areas to love watching butterflies. Because here in Harbin, it can be said that six months of the year is winter. Summer is very short, only one to two months. Considering that some scholars (Chapter 3) have observed a large number of butterflies in the hundred flower garden of the botanical garden, it is suggested to build a simple butterfly garden here. And the Berberis trees planted near the hundred garden are also honey plants. The construction of the butterfly garden can also teach children how some trees are propagated (Figure 4-4).



[Figure 4-4] Location of Butterfly Garden

4.3.5 Fruits garden area

The Fruits garden mainly introduces and cultivates various fruits ornamental plants and melon plants. The garden is built with an arc-shaped cane rack corridor, plants like gourd and loofah are snaking up. In this area, it is a very good environmental education content to let children experience the management and harvest of fruits. And according to the children's building behavior (Chapter2), and 'needs of a special place'. The management and construction of simple Tee Pee garden is suggested here.

4.3.6 Clove garden area

According to the third chapter, we know that lilac has a lot of historical and cultural stories to explore. By understanding the history of lilac, children can

understand why Harbin city they live in has such a unique urban landscape and culture. It involves the development history of Harbin as a border city between China and Russia. Here, it is emphasized that forest environmental education is not limited to forest education. Through the education of regional culture contained in special plants (cloves), children will understand the uniqueness of the place where they live. It helps them to develop their sense of belonging and correct environmental awareness.

The unique fragrance of lilac is also a good material for environmental education. Because children have a keen sense of smell, when they connect with the natural environment through smell, it is easier to build their attachment to nature.

4.3.7 Larix garden area

These mysterious animals can not be seen in Harbin city. But these animals live in the north forest not far away. Pictures of these animals are shown here to stimulate children's imagination and achieve the goal of environmental education. There is enough space under the larch forest area, which is suitable for some exhibition space. The forest in Daxinganling is mainly composed of Larix gmelini, which is a part of coniferous forest around the Arctic. It is distributed in China from north to south along Daxinganling. There are unique Arctic species associated with the forest, such as snow rabbit, moose, snow swan, and other animals and plants such as Duxiang, blueberry, rock orchid, etc.

4.3.8 Yew forest area

Yew garden, covering an area of 5212 square meters. There are more than 400

Taxus trees planted in the garden, which have been 30 years old. They are big trees planted and cultivated in the botanical garden. Yew, also known as Taxus, is a rare natural anti-cancer plant recognized as endangered in the world. It has been designated as a national first-class key protected wild plant in China, and it is a real “plant giant panda”.

4.3.9 Summery

8 regions in total were selected as the place for environmental education programmes. The education contents of each region are as follows (Table 4-1):

Area	Education contents
1. Living collection area	Knowing trees
2. White Birch forest area	Northern Nomadic Story with Birch 1) Birch bark cultural items 2) The simple words of national language
3. Pine forest area	Camphor pine forest and life 1) Different wood materials 2) Squirrel 3) Resin
4.Hundred flowers garden area	Knowing butterflies and forest
5. Fruits garden area	Garden management
6. Clove garden aera	Clove from afar 1) story of lilac 2) fragrance
7. Larix garden aera	Mysterious animals in northern forest
8. Yew forest area	Learn the value of Yew 1) Medicinal value 2) The Reason to be selected as Rare tree species

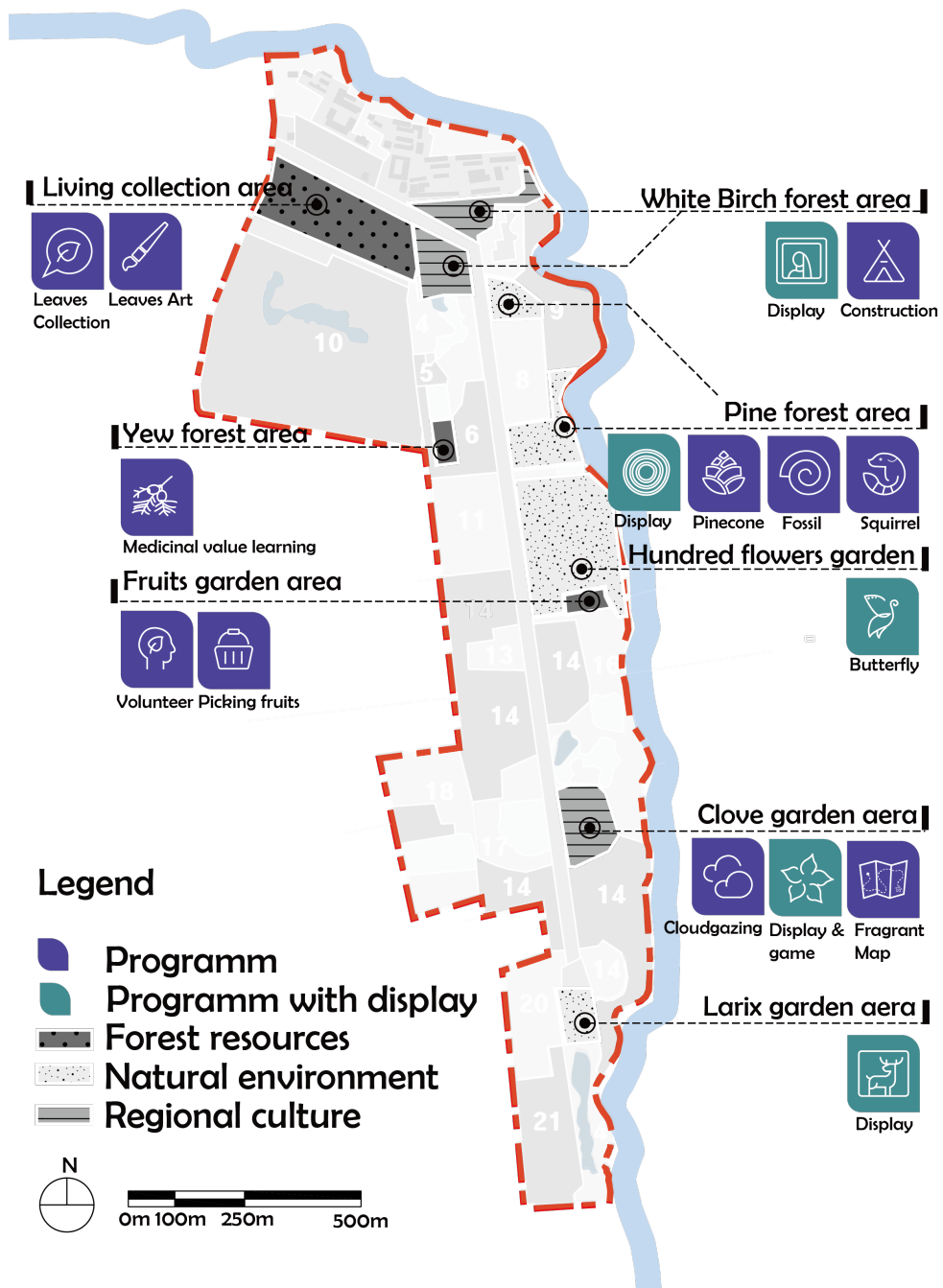
[Table 4-1] 8 regions and programmes

4.4 Programme design for different age group considering in children' s development

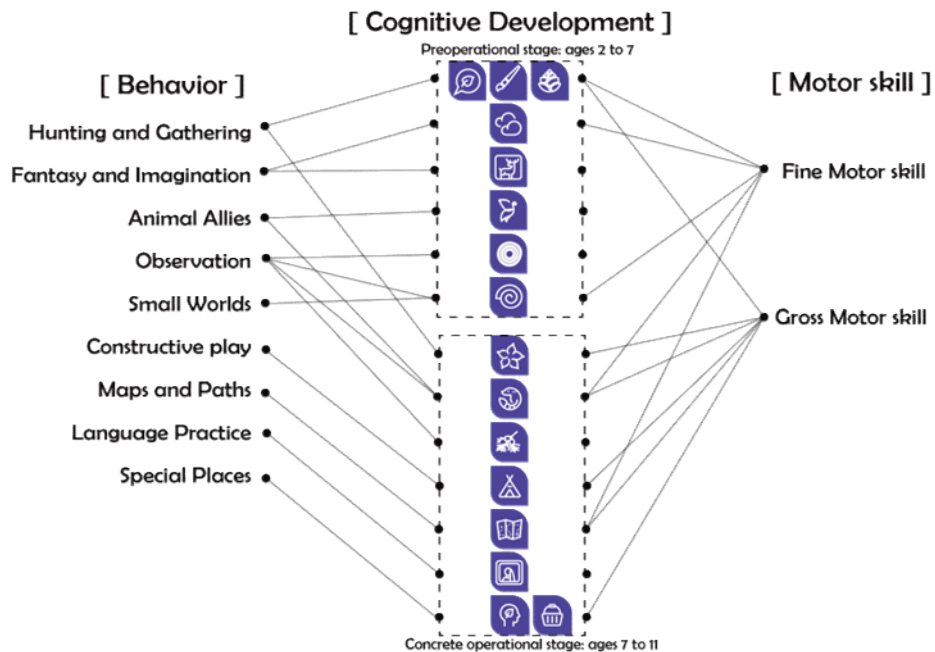
After the education content of each region is clear, next step is to figure out what kinds of specific programmes can convey this education content. So among the eight regions, there are 16 activities (Figure 4-5,6) in total are designed, which fully considered the Children' s stages of Cognitive Development, Different types of play of different age group, Children' s play and nature place, Fine motor skill and gross motor skill for childhood development (Figure 4-4). As a result the programmes are devided into diferent age group(Table 4-2).



[Figure 4-5] 16 activities



[Figure 4-6] Programme Planning



[Figure 4-7] The development of children connected with the 16 activities

4.4.1 Programmes for early childhood

To let early childhood children start to know the nature with playing, there are 6 type of programmes are considered under the existing resources in HFBSG. The types of early childhood programm includes hunting, immersing in fragrance, making fossils, using leaves and pinecones to do art works, observation of butterfly, and a series of displays that enable children to understand the forest and our daily life, knowing the story of northern nomadic people, the history of Harbin, and the activities of animals in northern forest.

4.4.2 Programmes for middle childhood

For the middle childhood, specific activities are designed to connect them directly to the forest. The hunting play - Find the Cloves with five petals can establish the interest of observation. The construction programme help them to get the hands-on ability. The Garden management programme satisfied the needs of children's nature of having their own small world and also it can develop their sense of responsibility. Through the map making programmes, children can not only develop their observation ability, olfactory, and expression ability use pen and words. The Yew tree is a national protected tree. We should have some education for the new generation, let them gain the environmental awareness from childhood. Since the early childhood children do not have the ability of logical reasoning, the target group here should be the middle childhood. The 8 unlimited in age programmes are also included here.

4.4.3 Programmes for mixed age group

The main purpose of the environmental education project here is to establish the relationship between children and forest so that children can have environmental awareness from childhood, so that the forest can be fully utilized. But when children participate in activities, they get not only environmental awareness, but also more abilities. There are also some theorists who stress that mixed age group activities can help children grow faster mentally during the play, so here are three activities proposed for mixed age groups, such construction, picking fruits. For younger children, it can help them to develop the social play ability, and learning how old brothers and sisters act as an older in a group. For older children they can gain the abilities like leadership, organizational skills, and also they will learn how to help the younger people in a group.

Age group	Play behavior type	Programme type	Programme name
Only for Early childhood 3~6 Kindergarten	Hunting, collection	Hunting, collection	1. Rainbow hunt game/ Leaf Matching 2. Collect leaves and drawing
	Physical play	Immerse (smell)	1. Cloudgazing with the fragrance
	Handwork	Make fossils	1. Observation Resins and Make your own fossils
Both for Middle and early childhood	Imagination	Art (No age division)	1. Collect leaves and drawing 2. Art of pinecone 3. Cloudgazing
		Display (Unlimited)	1. Know the different wood texture 2. Northern Hunting Story and birch forest 3. Clove from afar 4. Mysterious animals in northern forest
	Observation	Observation of butterfly (Unlimited)	1. butterfly gardens
Only for Middle childhood 6~12 elementary school	Hunting, collection	Hunting, collection	1. Find the Cloves with five petals
	Construction	Construction	1. Building birch bark house 2. Building Warren 's house
	Needs for Special place	Garden management	1. Volunteer
	Mapping	Fragrant map	1. Making The most fragrant map
	Logical thinking (cognition)	Learning the medical value	1. Yew Saved Xiong' er
Only for Mixed age group	Construction	Construction	1. Building birch bark house 2. Building Warren 's house
	Needs for Special place +Role play	Picking fruits	1. Bonnie bear' s helper

[Table 4-2] The programmes linked to the different age groups

4.5 Monthly Program description of each area

The 16 activities in each month are explained in the following table (Table 4- 3, 4, 5, 6). Since the botanical garden is open from the middle of April to October 31 every year, the time of the project is also arranged from April to October.

Time	Programme	Explanation
April~ May	Education content: Clove from afar programme name: Clove from afar Programme type: Display (history of lilac) and Game with rule (Find the Cloves with five petals).	First ask the children if they know the lilac? Lilac is the representative flower of Harbin. Then explain how the lilac came. Then tell the children about the history of lilac and Harbin, legend about lilac in Russia. There is a beautiful legend that each clove has four petals, but one clove tree has five petals. If you can find a lilac with five petals, you can make a wish. There is a folk legend said only those who really love each other can find two five cloves on the same tree!
April~ May	Education content: Clove from afar programme name: Cloudgazing with the fragrance Programme type: Immersion in nature/ smell / art	First, let children lying on grass and stone, feel the fragrance of cloves under the sunshine. Bring a pad and pencil out and ask kids to try drawing a few of the clouds they see. Jot down descriptions of what they might be doing — for example: “Camel, wearing a cowboy hat, about to board a gigantic ship.”
April~ May	Education content: Clove from afar programme name: Making The most fragrant map Programme type: : Children’ s map work	Let children to take paper and pen to find the most fragrant spot in the garden. Then write down or draw with pen and paper how to get to this place. Let them try to express the environments there is there any strange stone around it, or is there any bees, can you see the sky? After thry come back let them introduce their own fragrance map to other children.

[Table 4-3] Programme Planning explanation

Time	Programme	Explanation
June~ July	Education content: Camphor pine forest and life programme name: Building Warren 's house ²²⁾ . Programme type: Display + construct	First, let them know the how to use the tools safely. Then under the leadership of the staff, the children used the existing tools to make squirrel houses in the form of group tasks.
June~ July	Education content: Camphor pine forest and life programme name: Observation Resins and Make your own fossils Programme type: Resins observation, handwork	First, let the children smell the smell and tell them that the smell comes from the resin. Then let the children find the resin and observe them. Then tell the children how the resin formed and the application of resin in our life. Then tell the child about the relationship between resin and fossils. Then teach the children to make their own fossils.
June~ July	Education content: Knowing Butterflies programme name: Butterfly-Xionger' s best friend – Visiting Butterflies garden ²³⁾ Programme type: Learning about insects	Before entering the butterfly garden, ask the children if they have ever eaten silkworm chrysalis (large-scale silkworm chrysalis is a family delicacy in Northeast China). Then tell the children what the chrysalis is and what it has to do with butterflies. Then teach them the relationship between butterflies and the forest.
August	Education content: Camphor pine forest and life programme name: Art of pinecone Programme type: : Art	Because the pine forest is next to the most popular tulip garden. The number of tourists is very large during the flower season , so this programme will take place in the deep of pine forest. So the botanical garden should prepare some foldable tables and chairs. There should be some works of art on wechat platform, to inspire children's creation.
August	Education content: Camphor pine forest and life programme name: Know the different wood texture Programme type: Display	Tell them the Pine and the Ashtree are commonly used wood for furniture making, so it's easy to be seen in daily life. They have different textures which is fun to do comparison. And leave the task of observation for the children to observe furniture's tecture of their home.

[Table 4-4] Programme Planning explanation

22) Warren is a Character of cartoon bonnie bear, it is a squirrel.

23) Xionger is a Character of cartoon bonnie bear. The butterfly is his best friend.

Time	Programme	Explanation
September	Learn the value of Yew programme name: Yew Saved Xiong' er Programme type: Learning the medical value	The explanation of the application value of plants might be boring for the younger children. Older children have the ability of logical reasoning, which is more suitable to understand this part of knowledge. Tell the children that the tree is 40 years old. They will understand why it is so rare if they know the reproduction process of yew. And explain the medical value of them.
Late September~ October	Education content: Knowing trees Programme name: Leaves hunting Programme type: Collection	Before heading outside to find items for a mission list, ask children what they can see outside is Fall (leaves changing colors, animals foraging for food, getting cold, etc.). Print out the mission list and collect items from nature that are similar colors (red/orange/yellow/green/brown).
Late September~ October	Education content: Knowing trees Programme: Forest artist Programme type: collect leaves and drawing	As the seasons change. Different things can be found in the forest, such as leaves or flowers, branches or any fruit, which will become the raw materials of art.
October	Education content: Northern Nomadic Story with Birch programme name: Northern Hunting Story and birch forest Programme type: Display + Language play.	introduces the origin of nomadic people and how they use the northern forest to maintain their nomadic life(Chapter 3). The display items can be Birch skin crafts, such as boats, containers for rice, kettles, etc which can let children think of their life. Also the pronunciation of some items can also be taught at the same time.
October	Education content: Northern Nomadic Story with Birch programme name: Building birch bark house Programme type: Construction	The children were led by birch bark craftsmen. The children will finish construction of a birch house together as a team. Then it will be on display there until the next activity. In the next construction activity they will be demolished and rebuild.

[Table 4-5] Programme Planning explanation

Time	Programme	Explanation
October	Education content: Mysterious northern forest programme name: Mysterious animals in northern forest (photography exhibitions.) Programme type: Display	First, tell the children that the trees in this botanical garden are the trees that represent the forests in the north of our country. Although we can't see these animals in the city, we need to know that the north forest is the home of these small animals. The fire in Daxinganling made these animals homeless. The space under the larch forest can be used for some photography exhibitions.
April~October	Education content: Garden management programme name: Volunteer Programme type: Garden management	The management of the orchard can be in the form of volunteers, and children can be recruited to manage it. For children, they need to belong to their own special site, or a fruit tree to be taken care of. Hard and soft-ware support: Training from staffs who manage the garden. Wechat public platform can be used as a platform for raising volunteers, and update the daily photos of administrators on wechat platform and select the quarterly excellent administrators.
June~October	Education content: Garden management programme name: Bonnie bear's helper Programme type: Picking fruits	Fruit picking is easy for adults, but it's not for tiny children. This programme should be built in the form of a task by a mixed age group. Shorter children and bigger children should be combine in a team to finish a mission of picking. And that is also good for developing children's social ability.

[Table 4-6] Programme Planning explanation

4.6 Activity organization method

4.6.1 Permanent and Regular environmental education programmes

1) Permanent. There are two ways to carry out environmental education in this botanical garden. One is a permanent exhibition programme, the other is a regular type of programme. Display is an effective means in education project which we can know through the case study of Japan in chapter 2. The existings in HFBG is just showed in explanatory text which is not easy to achieve the goal of environmental education. So they need be improved by a combination of photos, text and items, which are much more easier for children to accept (Table 4-6). Also, the display can support the regular programmes well. Four places are proposed for display, including birch forest area, pine forest area, clove garden area and Larix garden area.

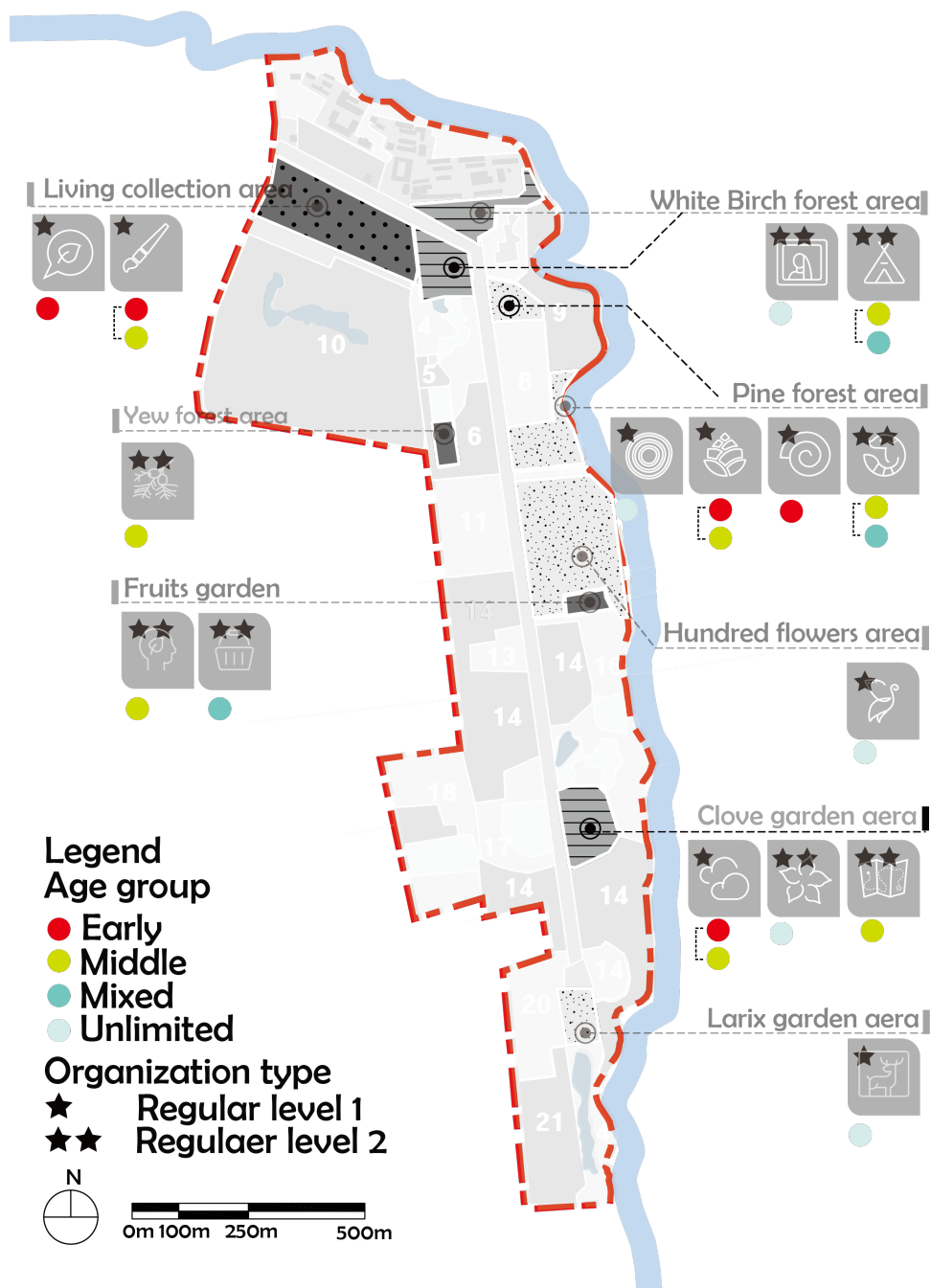
Area	Theme and Components of the display
1. White Birch forest area	Theme: Northern Nomadic Story with Birch Components: Text about Northern Nomadic Story with Birch / Pictures of nomadic people in northern China wearing national costumes, pictures and objects of birch bark crafts.
2. Pine forest area	Theme: Camphor pine forest and life display Components: Photos of different Wood grain and corresponding trees / Description of wood texture, applied field, price, etc
3. Clove garden area	Theme: Clove from afar Components: Photos of Harbin's urban area and railway construction in the early 20th century/ Photos of a Russian courtyard in Xiangfang District/ Explanation text of the origin of lilac as city flower/ The legend of lilac
4. Larix garden area	Theme: Mysterious animals in northern forest Components: Photos of unique arctic species such as snow rabbit, moose, snow swan, etc.

[Table 4-6] Theme and Components of the display

2) Regular. The Level 1 of regular programmes is mainly aimed to let children get close to nature, feel nature and form a certain connection with nature, which is led by staff in the whole process. It is mainly designed for early childhood children. It includes programme type such as: collecting, art work, observation, feel the fragrance of nature. But early childhood children are also be suggested to join some mixed age programme to learn from the old brothers and sisters. The main purpose of level 2 programmes is for children to understand forest plants and the relationship between forests and people and through some simple or difficult activities that need group cooperation or finish some mission by themselves, let them directly establish a relationship with nature. It is mainly designed for middle childhood, but some fo them is proposed for mixed age. It includes programme type such as: Art work, construction, handwork, garden mamagenent, volunteer, learning history of the city or Middle value of trees, map making(Table 4-7)(Figure 4-8).

Level	Theme and programme of the regular	
Level 1	April-May	Education theme: Clove from afar 1. Find the Cloves with five petals 2. Cloudgazing with the fragrance
	June~July	Education theme: Knowing Butterflies 1.Butterfly-Xionger’ s best friend (Visiting Butterflies garden)
	August	Education theme: Camphor pine forest and life 1. Know the different wood texture 2. Art of pinecone
	Late September~ October	Education theme: Knowing trees 1. Rainbow hunt game/ Leaf Matching 2. Collect leaves and drawing
	October	Education theme: Mysterious northern forest 1. Mysterious animals in northern forest (photography exhibitions)
Level 2	April-May	Education theme: Clove from afar 1. Making The most fragrant map
	June~July	Education theme: Camphor pine forest and life 1. Building Warren ‘s house 2. Observation Resins and Make your own fossils
	September	Education theme: Learn the value of Yew 1. Yew Saved Xiong’ er (Learning the medical value)
	October	Education theme: Northern Nomadic Story with Birch 1. Northern Hunting Story and birch forest 2. Building birch bark house
		Education theme: Garden management
	June~October	1. Bonnie bear’ s helper(Picking fruits)
	April~October	2. Volunteer

[Table 4-7] Regular environmental education programmes



[Figure 4-8] Age group and level of each single regular environmental education programmes

4.6.2 Combination with school curriculum

Learning from the practices of foreign botanical gardens, HFBG can try to carry out forest environmental education programmes combine with long-term school science curriculum. The forest 101 project in South Korea is an excellent case of long-term cooperation with the curriculum of nearby middle schools. This case has received good social and international response.

According to the teaching constitution of our country, the natural science curriculum is from grade 3 to grade 6 of elementary school, and the biology curriculum is started at the beginning of middle school. Therefore, it is proposed that HFBG can make a cooperation with surrounding schools. In terms of personnel allocation, it can be considered to recruit volunteers or cooperate with students from Northeast forestry university. In this way, when children learn natural science, they also cultivate the sense of belonging. It also provides more employment opportunities for students of Forestry University.

According to the constitution of our country, the natural science curriculum is from grade 3 to grade 6 of elementary school, and the biology curriculum is started at the beginning of middle school. Therefore, it is suggested that the primary schools around the botanical garden can carry out natural science courses and art courses. And the Ministry of education can set up local forest learning courses or schools around the botanical garden can set up school-specific forest learning courses.

Type	Grade	Programme name
Art	Grade 1~3	Rainbow hunt game/ Leaf Matching Collect leaves and drawing Art of pinecone Observation Resins and Make your own fossils
	Grade 3~6	Mysterious animals in northern forest (photography exhibitions) Making The most fragrant map
Science	Grade 3~6	Know the different wood texture Butterfly-Xionger' s best friend (Visiting Butterflies garden) Yew Saved Xiong' er (Learning the medical value)
School special curriculum	Mixed	Northern Hunting Story and birch forest Building birch bark house Building Warren 's house Bonnie bear' s helper (Picking fruits) Volunteer of garden management

[Table 4-8] Programmes Combination with school curriculum

Chapter 5 Management and Operations

5.1 Management Model

5.1.1 Government-led Management Model

At present, the environmental education programmes of Heilongjiang Forest Botanical Garden is in the initial stage of development. The government led operation mode will play a leading role in effective publicity, capital preparation, infrastructure construction and improvement, personnel training and other aspects.

Through the study of the composition and responsibilities of the institutions, it can be seen that Chinese forestry sector does not have a department for forest environmental education or forest related social welfare. If we see the foreign advanced cases, take South Korea as an example., in 2016, the State Forestry Administration-Korea Forest Service set up a separate agency- Korea Forest Welfare Institution. It is specially responsible for providing forest welfare, such as forest environmental education and forest therapy. In addition, it also runs the forest therapist training program for a long time operation of the forest related program.

In Chian, the professional science popularization personnel of domestic botanical gardens are seriously insufficient, which limits the Implementation of long-term environmental education. Under ideal conditions, it is proposed that Heilongjiang Forestry and grassland Bureau should set up Environmental education related departments to give back forest related welfare to the society.

5.1.2 Government-led Project Company Model

Lithuania is a typical case of forest closing delivered to the company. The purpose of the activities of Joint Stock Company “Latvia’s State Forests” (LVM) is administration of state-owned forest property and management of public forest, ensuring preservation and increase of its value and generation of revenue for its owner – the State. The highest executive body of LVM is the Board. As at 31 December 2014, the LVM Management Board consisted of 4 members: the Chairman of Board and 3 Members of Board. Pigman is the main “super-hero” of the eco-programme “Pigman’s detectives” is one project managed by LVM. During the five years of programme’s existence, more than 20 000 children of Latvia have been directly involved. its activities on the principles of entrepreneurship, that is, to invest resources in the company and gain economic benefit in the future. The separation of the supervisory and economic management functions has allowed to diminish both conflicts of interests and impact of corruption in the forestry sector.

As for China, it is not realistic to hand over the forest resources to the company for management. Because this will suddenly weaken the role of the forestry sector, and the hierarchical mechanism of China’s forestry sector also largely limits this mode of full delivery. Therefore, it is proposed that only for the management and operation of environmental education, can use the Government-led Project Company Model. The government establishes a corresponding environmental education project development and management project company or cooperate with company, injects the project in the form of relevant assets and government financial allocation (or in the form of assets, the asset owner owns the corresponding equity of the project company), and the

project company mortgages the assets injected by the government organization. Loans to the bank, the funds obtained are used for the development and management of projects, and the proceeds from the projects are used to repay the bank loans, thus progressive develop the Forest environmental education projects.

5.1.3 Government Sponsored Young Entrepreneurs projects model

In recent years, many regions in China have implemented government incentive entrepreneurial fund projects, for example, Harbin has set up the “entrepreneurial guidance fund”. So it is suggested that the government can set up such as the northern forest resources entrepreneurship fund to give young and passionate college students a chance to gather better ideas and give them a chance to practice the management. (Refer to the case study of Brazil in chapter 2)

5.1.4 Cooperation with Chinese Academy of Sciences Model

At present, 15 Chinese Academy of Sciences Botanical Gardens (including those jointly managed by local governments) are under the management of CAS, which have become the core of modern Chinese botanical gardens in China, with the main tasks of carrying out plant resources investigation, introduction and domestication, scientific research and resource application, environmental education and gardening. It also has become an important force of international botanical garden.

The Chinese Academy of Sciences attaches great importance to the cultivation of science popularization talents. Since 2013, the Chinese Union of Botanical

Gardens (established by the forestry department under the leadership of the Chinese Academy of Sciences) has held a 15 day “advanced training course on environmental education research and practice” which is one of the “Huangpu classes” of the Chinese Union of Botanical Gardens, and the other two are “training courses on gardening and landscape construction” and “training courses on plant classification and identification”. By the end of 2019, the training course has trained 189 environmental education talents for various botanical gardens and relevant institutions in China; Chinese Union of Botanical Gardens has also selected outstanding students to study and exchange in foreign botanical gardens, thus broadening the international vision and cooperation channels of professionals. It has continued to improve and optimized popular science education activities. It is proposed that the management mode of Heilongjiang Forest Botanical Garden can be changed into a cooperative management mode between the government and the Chinese Academy of Sciences.

5.2 Operations

5.2.1 Logo design use the famous cartoon image

This famous cartoon Bonie Bare is based on the original forest of Harbin, and tells the story of the confrontation between the deforester and the protectors (bears and squirrels, etc.). It is the favorite cartoon of Chinese children in recent years. Therefore, HFBG’s environmental education programmes can combine this cartoon to absorb the current popularity and use the characters, or using stories to design programmes, brochures which may be easier to win the favor of children(Figure 5-1).



[Figure 5-1] Example of logo design

5.2.2 Membership system

Membership system is to attract customers to join voluntarily. The purpose is to contact members regularly and provide them with a higher perceived value. Membership system is a frequently used management method to stimulate users in foreign Parks and Botanical Gardens. Also the network membership model among several garden or park. At present, there is no park and garden membership network in Harbin. And most of the parks and gardens are free to visit.

China (Harbin) forest museum is located in the campus of Harbin Forestry University. It is the first forest themed Museum in China opened in 2013. University museums have made positive contributions to meet the growing needs of the people in spiritual culture, education and learning. China (Harbin) Forest Museum is jointly built by Northeast Forestry University and all sectors of the society. It is free to open from 9:00-16:00 on Thursday, Friday and Saturday. There are two periods of free tour guide service time in each day, 9:20 and

14:20. Since its opening, the museum has devoted itself to forest environmental education. It has become the main base for the dissemination of forest culture to young people. Also it has established tea culture studio and traditional handicraft culture studio as traditional culture base to spread Chinese forest culture to primary and middle school students. Volunteers in the museum go out of the campus, hold propaganda activities in communities and primary and middle schools, spread tea culture and forest culture, and hold traditional Chinese handmade propaganda in the international student center, spread traditional handmade culture.

Therefore, it is proposed that the environmental education projects of Harbin Forest Museum and HFBG can be formed into a membership network. For example, when children participate in the membership, they will give discounts to the admission fees of the botanical garden or the participation fees of the environmental education project. New exhibitions and activities of museums and botanical gardens will be sent to members regularly. And members can score points every time they complete an environmental education activity. Every year, this membership platform will select the best forest students of the year.

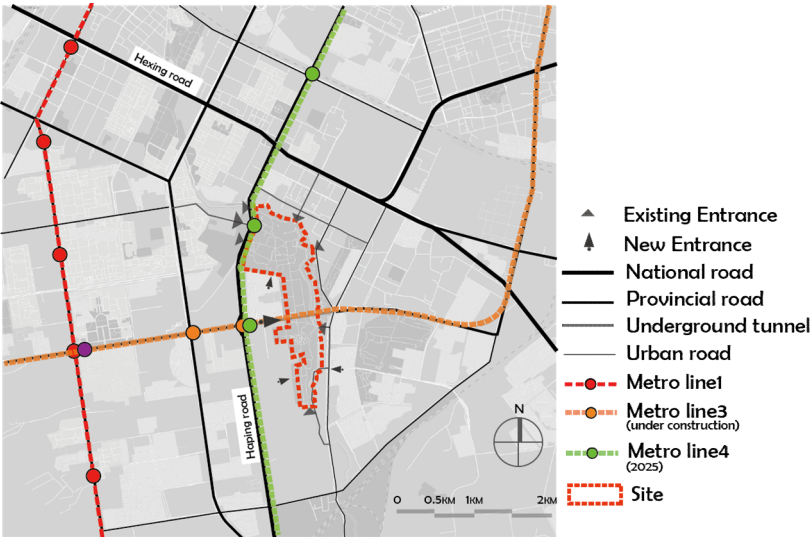
5.3 Special Prevision for Education Programme

5.3.1 Improve Accessibility

There are 5 entrances in the north side, 1 in the South and 1 in the East side. It can be seen from the current situation of land use around the site that the west side of the botanical garden is a residential area. But there is no entrance. It is very inconvenient for residents to use it. And the lack of entrances also led

to the inconvenience of tourists. There is no way for tourists to leave the botanical garden immediately if they want to five up the tour route. Through the chapter 3, we already know that by 2025, two subway lines will be built in the west side around the botanical garden, and a subway station will be built 500 meters away from the botanical garden. In order to develop the environmental education project well, it is necessary to add more entrances.

Therefore, it is suggested to add a main entrance on the west side, which is specially set for tourists who come to visit by subway. Considering the high flow of visitor traffic , it is suggested to set up an entrance square here to avoid the crowd. However there still need some small residential entrances (as shown in the figure) on the East and west sides to improve the accessibility of the botanical garden for surrounding residential. Considering that the botanical garden implements the charging system, the establishment of membership card and automatic fee deduction mode is proposed.



[Figure 5-2] Improve Accessibility

5.3.2 Exhibition Space

In order to make the environmental education more vivid and the display stands need a certain space. Take the example in Tama Forest Science Garden, there can be a display stand for small model made of wood. The display space of northern nomadic culture in birch forest and the pine forest display can use this style(Figure 5-3).



[Figure 5-3] Exhibition Space
Source: Figure “Forest Post” of the report of “Forest Education in Japan” 24)



[Figure 5-4] Elevated Observation Walk
Source:
<http://www.cheekiemonkie.net/2017/06/Learning-Forest-Singapore-Botanic-Gardens-review.html>

5.3.3 Elevated Observation Walk

The elevated observation walk will be set up in the living collection garden, which is a good place for close observation of trees due to its wide variety of species. In the elevated observation walk children can not only observe the plants, but also climb in the mesh weaving area or just lie down and watch the sky. In the prominent platform, painting, manual and other activities can be carried out(Figure 5-4).

24) Mariko INOUE, Forest Education in Japan Historical Review; Current Forestry Practices, Forest Management, and Wood Processing Education; and Future Expectations, Tama Forest Science Garden Forestry and Forest Products Research Institute, March 16, 2020, p.13.

5.3.4 Forest classroom

There are several small resting spots in the botanical garden and some of them are old. Considering activities such as collection and painting in the living collection garden and pine tree garden, some of these small rest spaces are proposed to be re-designed. For example, in figure 5-3 it shows the original space, the figure 5-4 shows the re-design recommendation example of this place, The paving material can be sand which is friendly for children, and a round shaped table can be used for children's art work, and the teacher can easily guide them in the middle.



[Figure 5-5] Original look of resting spots
Source:<http://www.hhfgs.com/nry.asp?id=54243>



[Figure 5-6] The example of re-design

Chapter 6 Conclusion

Urban forest botanical garden is not only have ecological significance in the city, but also have educational significance. Heilongjiang Forest Botanical Garden, as the unique forest botanical garden located in the city center of China, its forest resources are abundant, accounting for 80% of the botanical garden's area. The function of forest environmental education are of great theoretical and practical significance to awaken the public's forest ecological awareness and improve environmental protection awareness. Due to the high accessibility, urban forest botanical garden provides an excellent place for the development of forest environmental education.

The goal of environmental education is to enable children to understand the northern forest through the activities which are suitable for their development, as well as the natural environment they live in. This programme of HFBG can be a start to stress the importance of forest education especially for children to realize sustainable forest utilization and conservation.

In the analysis on the site, this paper expounded the basic information of Harbin, accessibility, surrounding situation and development history of the botanical garden. Then it analysed the internal landscape, including the current planning, land use, landscape types, buildings. Finally, in the process of understanding the key natural resources of plants, the soil types, water bodies, forest resources, and insect resources are introduced. In the analysis of the target group children, in order to know the social needs and suggestions of Harbin citizen for FEE programme. There are 93 questionnaires in total were collected, half of them are

parents. The result showed that many parents are having concerns about the time of the program, and what they recommended is that they hope the programme can be combined with school. Thus, 3 directions of education program planning are decided:

1. The education content should be summarized from the site.
2. Different types of FEE Programmes for Different Age groups.
3. When considering the operation, the programme should be 3 type: Regular programme and Permanent programme in Botanical garden and a school - botanical garden corporation programme.

The representative of the northern forest, has its regional representativeness (species of Xing'an Mountain and Changbai Mountain); there are also butterflies, squirrels and other animals to form the natural environment; and the northern forest has the representative life of the northern nomadic people; the lilac in this botanical garden can tell the regional history and culture of Harbin. Therefore, the content of forest education in HFBG should be classified into 3 component :

1. Forest resources (use of forest products)
2. Natural environment (Forest environment, forest ecosystems)
3. Regional culture (Natural features, Regional culture).

There are three ways to carry out environmental education in this botanical garden. One is a permanent exhibition programme, second is a regular type of programme, third is a school-botanical garden corporation programme. Four places are proposed for display, including birch forest area, pine forest area, clove garden area and Larix garden area. Butterfly garden is an independent operation system. The regular programmes are

including 2 phase: phase 1 is mainly aimed to let children get close to nature, feel nature and form a certain connection with nature, which is led by staff in the whole process. It is mainly designed for early childhood children. It includes programme type such as: collecting, art work, observation, feel the fragrance of nature. But early childhood children are also be suggested to join some mixed age programme to learn from the old brothers and sisters. The main purpose of phase 2 programmes is for children to understand forest plants and the relationship between forests and people and through some simple or difficult activities that need group cooperation or finish some mission by themselves, let them directly establish a relationship with nature. It is mainly designed for middle childhood, but some fo them is proposed for mixed age. It includes programme type such as: Art work, construction, handwork, garden management, volunteer, learning history of the city or Middle value of trees, map making. The school - botanical garden corporation programme will focus on the school coriculum, art and nature science class will be concerned to combined with this programme.

The cooperation of various social sectors may be a feasible way under the premise of the long-term forest environmental education activities in the botanical garden. 5 Management Models such as, Government-led Management Model, Government Sponsored Young Entrepreneurs projects model are proposed. Also, 4 operation method including Cartoon image for propaganda, Combination with school curriculum, the Special Prevision for Education Programme, are showed in this paper.

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초 록

중국 국내 환경교육은 비교적 늦게 시작되었지만 최근 몇 년 동안 중국은 환경교육을 중요하게 생각한다 (Jiao Yang 등, 2019, p1355). 도시 산림 식물원은 도시에서 생태적 중요성뿐만 아니라 교육적 중요성도 있다. 산림 환경교육의 기능은 대중의 환경 인식을 일깨우고 환경 보호 인식을 향상시키는 데 중요하다. 접근성이 높기 때문에 도시 산림 식물원은 산림환경 교육의 훌륭한 장소를 제공한다. 중국 도심 (Meng Bi, 2014, p38)에 위치한 유일한 산림 식물원으로서 산림 자원이 풍부하여 식물원 면적의 80 %를 차지합니다. 훌륭한 강성의 성도 하얼빈에 위치하고 있다. 그것은 식물 자원 연구, 식물 다양성 보호, 식물 지식의 대중화 및 중국 동북부의 식물 자원의 지속 가능한 개발에 중요한 역할을 한다. 그러나 현재 산림 식물원은 산림환경 교육에 충분히 주의를 기울이지 않다. 이 귀중한 산림 자원을 최대한 활용하며 이에 지속 가능한 발전을 위해서는 산림 환경교육 프로그램을 마련해야 한다. 사람들에게 복지를 제공하고, 사람들의 환경 인식도 불러일으켜야 한다.

어린이들을 위한 환경교육은 완전히 발달한 어른들의 교육과는 다르다. 아이들은 대부분의 시간을 놀면서 보낸다. 그래서 어린이 인지 발달, 신체발달 단계, 연령대별 놀이 유형, 어린이 놀이와 자연 장소의 규칙, 등의 관련 이론을 검토했다. 케이스 스터디를 통해, 세계에서 실천하고 있는 활동유형을 다음과 같이 요약될 수 있다. 8종 32개의 프로그램이 있다: 자연에서의 임메시온, 예술과 상상력, 게임과 스포츠, 숲의 가치 파악과 학습, 곤충과 동물 보호를 위한 식별과 학습,

수집, 건설, 환경 보호를 위한 특별 활동. 사이트 분석 단계에서 거시적 관점에서 사이트를 이해하기 위해 이 논문은 하얼빈의 기본 정보, 접근성, 주변 상황 및 개발 역사의를 설명했다. 그런 다음 현재 계획, 토지이용, 식물 경관 유형, 건물을 포함한 내부 조경을 분석했습니다. 마지막으로, 식물의 주요 천연자원을 이해하는 과정에서 토양 유형, 수역, 수목 자원 및 곤충 자원을 설명했다. 사용자분석에서, FEE 프로그램에 대해 하얼빈 시민들의 사회적 요구와 의견을 알기 하얼빈 시민 대상으로 설문 조사를 했다. 총 93개의 설문지가 수집되었다. 그중 50%가 부모이다. 80%의상이 환경교육실시에 찬성한다.

아이들이 생활하는 자연환경은 물론 활동을 통해 중국 북부의 숲을 이해할 수 있도록 하는 것이 이 환경교육의 목표다. 이 HFBG 프로그램은 특히 어린이들이 지속 가능한 산림 이용과 보전을 실현하기 위한 산림 교육의 중요성을 강조하는 출발점이 될 수 있다. 교육 프로그램 계획의 3가지 방향: 1. 교육 내용은 사이트 자원에 집중해야 한다. 2. 연령별 그룹을 위한 다양한 유형의 FEE 프로그램. 3. 운영을 고려할 때 프로그램은 식물원 정규프로그램과 학교 커리큘럼과 연계 프로그램 2가다. 산림교육의 내용의 구조는 3가지 요소로 분류하다. 산림자원(임산물 사용) 2. 자연환경(산림환경, 산림생태계) 3. 지역 문화(자연적 특징, 지역 문화)

따라서 환경교육 프로그램 대상지로 총 8개 구역이 선정됐다. 각 지역의 교육내용은 나무알기, 버치가 함께하는 북방유목 이야기, 소나무 숲과 삶, 나비알기, 정원관리, 멀리서 바라본 클로브, 신비로운 북부 숲, 유우의 가치 배우기 등이다. 8개 구역 총 16개 활동이 제안하

다. 프로그램을 연령층별로 아동초기, 아동 중반기, 연령혼성으로 아동 인지발달, 근육발달등을 고려해서 설계했다. 정규 프로그램은 2단계를 포함한다: 1단계는 주로 아이들이 자연에 가까워지고, 자연을 느끼고, 자연과 일정한 관계를 형성하도록 하는 것을 목표로 하고 있는데, 이는 전체 과정에서 직원들이 함께한다. 이는 주로 유아기를 위한 것이다. 이는 수집, 예술 작품, 관찰, 자연의 향기를 느끼는 것과 같은 프로그램 유형을 포함한다. 2단계 프로그램의 주요 목적은 어린이들이 숲 식물과 숲과 사람 사이의 관계를 이해하고, 집단 협력이 필요하거나 스스로 미션을 완수해야 하는 단순하거나 어려운 활동을 통해 자연과의 관계를 직접 수립하도록 하는 것이다. 그것은 주로 아동 중반기를 위해 고안되었지만, 몇몇은 혼성 연령을 위해 제안되었다. 여기에는 예술 작품, 건축, 수공, 정원관리, 자원봉사, 도시의 학습 역사 또는 나무의 가치, 지도 제작과 같은 프로그램 유형이 포함된다. 학교 커리큘럼과 연계 프로그램은 주로 미술과 자연과학과 연계로 제안하지만 학교 특색 수업으로도 가능성이 있다.

식물원에서의 장기적인 산림환경교육 활동을 전제로 하여 다양한 사회분야의 협력이 실현 가능한 방법이 될 수 있다. 정부 주도의 경영 모델, 정부 후원 청년 창업 프로젝트 모델 등 5가지 경영 모델이 제안된다. 또한, 학교 교육과정의 결합, 교육 프로그램을 위한 공간적 준비 4가지 운영방법에서 소개되어 있다.

주요어 : 숲, 도시숲, 숲 환경교육 프로그램, 식물원, 아동
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